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IMPROVED AUTOMATIC SMALL STEAM ENGINES.

We have from time to time, during the last few years, suggested that if some one should produce a really good small engine at a moderate cost, the sales would amply repay the outlay. Our suggestions have been responded to from every part of the country, and we are enabled, in this number, to present to our readers some fine illustrations of an engine which, although small apparently, possesses all the features of a first class motor. It is made self-acting as far as possible.

Fig. 1 is a vertical central section of one of these engines and its boiler. The latter is of the vertical tubular type with the fire box eccentric to the outer shell; from this fire box the products of combustion pass up through tubes, as shown by the arrows, into a space beneath the feed water heater, which is above the boiler, and thence through drop tubes and up the smoke stack, as shown in Fig. 2. Fig. 2 is also a vertical section, cut perpendicularly to the axis of the crank shaft and at right angles to the plane of Fig. 1. There are air spaces in the base which prevent the radiant heat from burning the floor, on which the machine may be placed with no other foundation. The engine is of the slide valve type, the cylinder being located in a large exhaust jacket, and that again in the feed water heater. The exhaust steam, therefore, not only prevents radiation and condensation in the cylinder, but also heats the feed water. There are two pipes for conveying the exhaust steam from the jacket. The pipe, H, extends to the bottom, and through this all the water of condensation may be removed, while the larger portion may be allowed if necessary to escape, through pipe, I, into the smoke stack, and force the draft. Dry exhaust steam is, therefore, always available to force the fire. The advantage of locating the feed water heater on top of the boiler, and making it a base for the engine, is obvious, as it protects the engine from the great heat of the boiler and saves all radiation from the top. The cylinder is 3½ inches in diameter by 4 inches stroke; the crank makes 300 turns per minute. The speed may, however, be changed at will by changing the tension of the governor springs. The feed pump is cast in the crosshead slide, and is inside of the frame, giving the engine a neat and uniform appearance, and it also enables the belt pulley to be placed very near to the pillow block bearing. It is provided with a safety valve, E, having a handle to turn the valve in its seat at each starting, thereby preventing it from ever becoming cemented down or stuck. Oil cups, gage cocks, and a glass water gage are also attached. The boiler pressure is kept uniform by an automatic damper regulator.

Fig. 1.

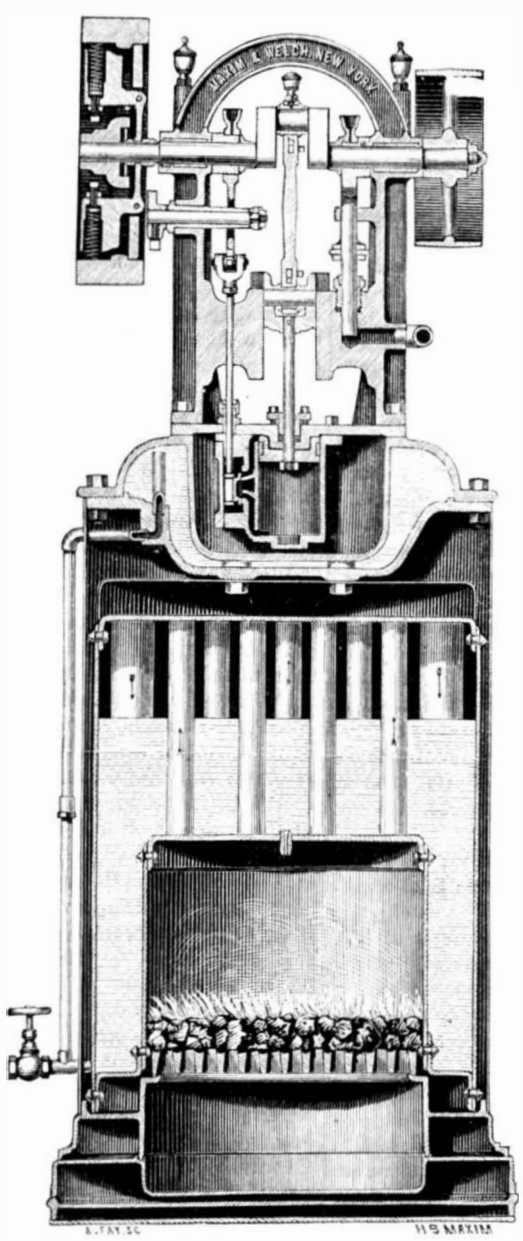
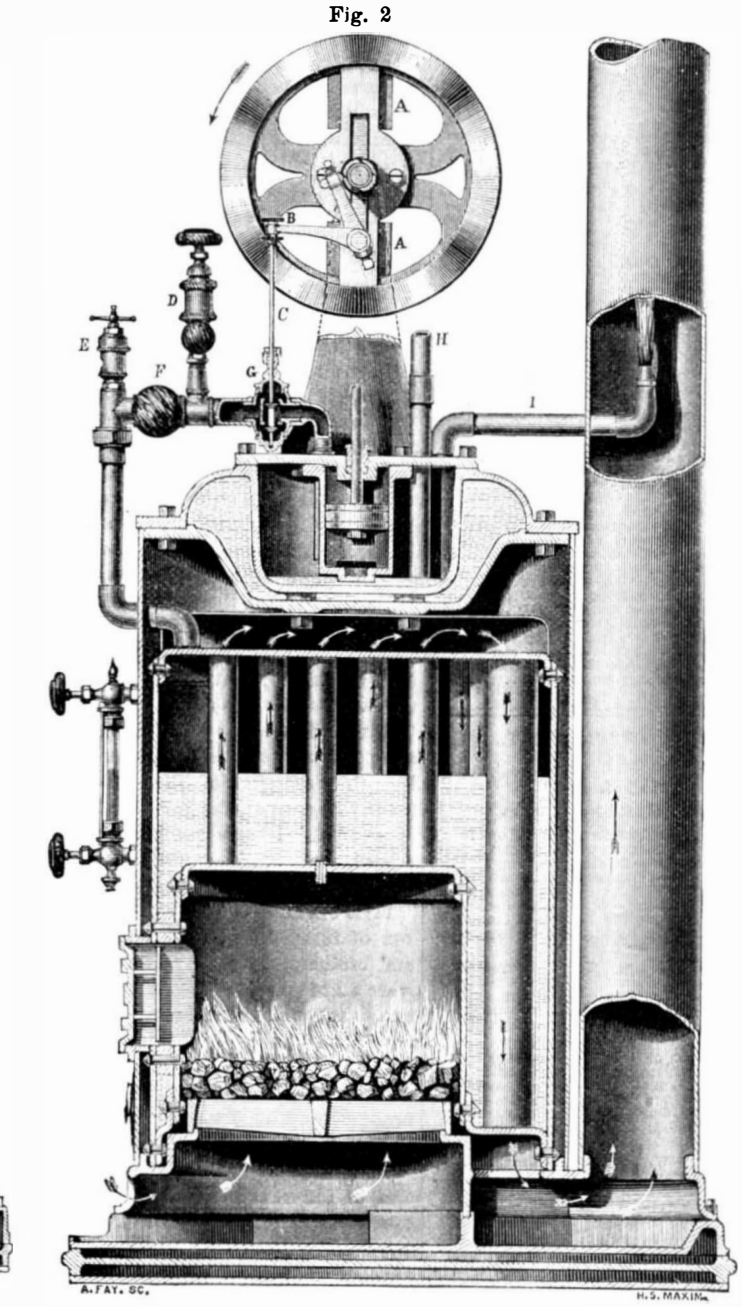


Fig. 2



MAXIM'S AUTOMATIC STEAM ENGINE.

A novel and important feature about this engine is its governor. We believe the present is the first instance of a small engine being provided with an automatic variable cut-off, the governor operating, as in the largest and best machines, directly on the point of cut-off. The economical advantages of this system are too well known to be recapitulated here. The object is attained in a direct and simple manner, no perishable belt being used. Two heavy weights, which constitute the balls of the governor, are placed inside of the fly wheel, and revolve with it, the centrifugal force being balanced with suitable springs, which may be adjusted at will, as shown in Fig. 1. The weights are attached to a bell crank, one end of which extends centrally and embraces a sliding cam, attached to the main shaft in such a manner that, while it is free to move in the direction of axis, it cannot turn on the shaft but rotates with it. This cam has two projections corresponding to the up and down stroke of the engine, as shown in Fig. 2. The advancing faces of these projections are parallel to the axis, and open the cut-off valve at the same time at any lateral position. The slide valve is made to cut off at ⅞ stroke, and the relation of the projection on the cam arc to the eccentric is such that, on the closing of the port by the slide valve, the balanced valve, G, is opened, and a full boiler pressure is let into the the steam chest, which is very small. The valve, G, only remains open during the time that the follower is resting on the projections. The terminations or receding faces of the cam projections are cut spirally in such a manner that, when the weights, A A, are thrown outward by a too rapid motion, it brings a shorter portion of the projections beneath the follower, and thus cuts off the steam at an earlier point of the stroke. Should the speed diminish, then the springs press the weight inward and allow the steam to follow the piston for a distance due to the work being done.

This governor may be applied to a larger class of engines, and would prevent wire drawing the steam and its attendant loss to a very considerable extent. Moreover, it is free from the dangers inherent to all governors requiring a belt to drive them, since the belt is liable to break, slip, or come off, and thus allow the engine to race, to the great danger to life and property, as many accidents attest.

One objection raised against small engines is the constant watching required to keep the right quantity of water in the boiler.

Fig. 3, page 290, is a view, partly in section and partly in elevation, of an ingenious automatic feed attached to these engines. The feed pump is of the ordinary solid plunger kind, with suction on one side and discharge on the other. There are two branches to the discharge, one of which passes to the boiler through the heater, and the other returns back to the tank from which the suction is taken. In this return pipe is placed a globe valve, E, with a sliding stem or spindle, which extends downwards and rests on the top of the shell, F. When the valve, E, is open, it is obvious that no water would enter the boiler, as it would discharge back to the tank; thus, when no water is being pumped into the boiler, the pump is not liable to become filled with air, but is always ready. The automatic part of the device relates wholly to the opening and closing of the valve, E. When the pump is working, it has to discharge its water somewhere; and if the valve, E, is closed, its only discharge is through the other branch and into the boiler. The shell, F, being full of water and oil and securely sealed, it forms a little boiler of itself; and steam is raised in it by the water falling in the main boiler and thus allowing the steam to displace the water in pipes, K and L, when the heat of such steam is rapidly communicated to the water in the shell; a pressure is raised, the elastic steel tap is expanded, which closes the valve, E, and the water at once enters the boiler; when sufficient water has entered, it closes the pipe, L, and soon fills the pipe, K. Then the shell, F, cools, a depression takes place, and the relief valve, E, is opened, which at once allows the water to return to the tank and not enter the boiler. When it is desirable to take water from mains which have a pressure in them, then the pipes, I and J, may be connected to allow the water to circulate when not going into the boiler. Should a larger amount of water be required in the boiler at any time than that due to the hight of the pipe, L, then the globe valve, B, may be closed; and the pump will throw its whole volume into the boiler, and it may be controlled in the usual way, by closing off, more or less, the angle valve, A. This feed water regulator is perfectly reliable, and in practice does not allow of a variation greater than the internal diameter of the pipe, L (¼ of an inch.)

Fig. 4, page 290, is a view of a noiseless, automatic pumping engine, using gas or coal as a fuel. It is automatic to a remarkable degree, the pressure, feed water, and fire taking care of themselves. They are highly finished and very neat in appearance, the boiler casing being 16 inches in diameter and 36 inches high; 25 cubic feet of gas per hour pump 250 gallons of water 100 feet high, or a larger quantity to a correspondingly less hight. This pump is very light running, and is practically noiseless, making less noise than a sewing machine. There is both an air chamber and a vacuum chamber; thus all noise from the impact of water and its disagreeable pounding in the pipe is avoided. With coal as a fuel, it is provided with a larger pump, and raises thrice as much water per hour as with gas. Fig. 5, page 290, is a vertical central section of the gas-burning pumping engine. The burner is a double argand, with 60 No. 60 holes, being the same size and once and a half the number used in a common argand as used for illumination. A represents the safety valve, B the heater, C C the boiler, D the counterpoise of float; E operates the boiler feed, G G are the pendent tubes, filled with water and forming a part of the boiler, H the burner, I the valve for automatically controlling the fire, by means of the piston, P, the lever, L, and spring, M; an inspection of the engraving will enable any one to comprehend the rest.

Fig. 6, page 290, represents a small oscillating engine, on

(*Continued on page* 290.)

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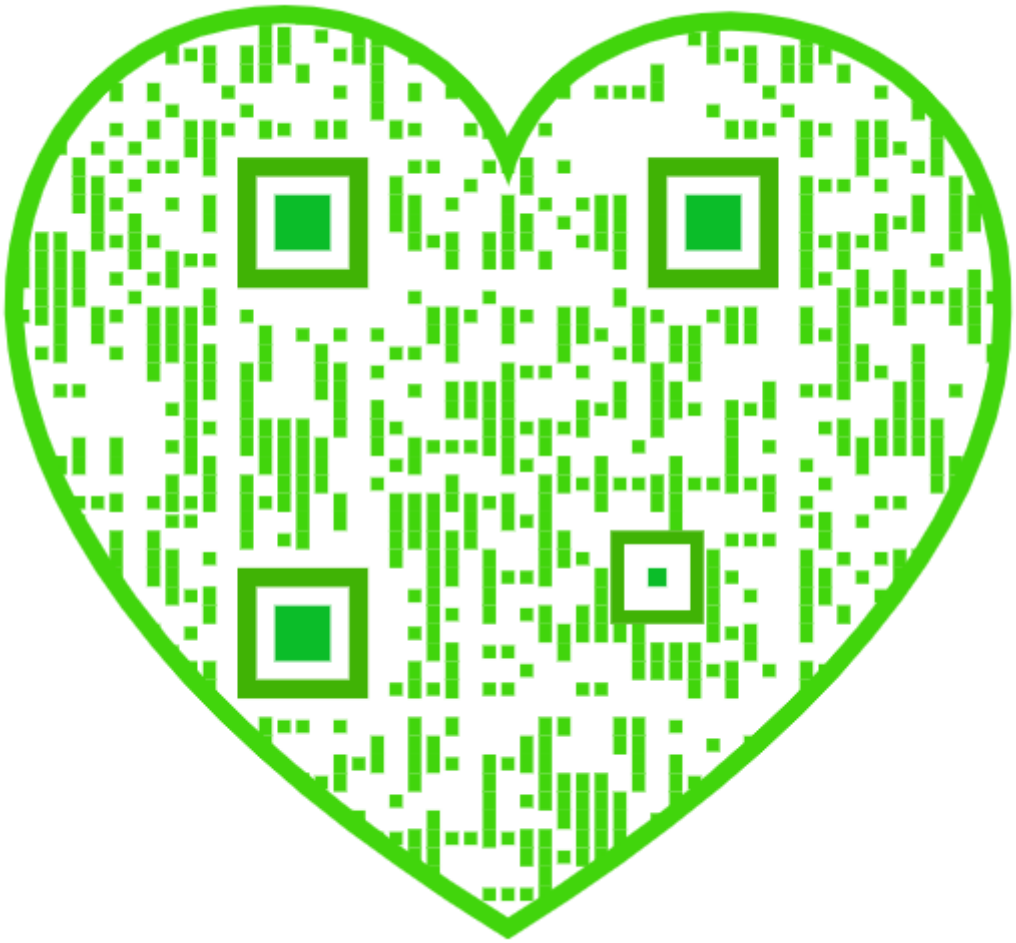

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THE best way to destroy thistles is to cut through the roots just before the buds form, with a spade, at a point 2 inches below the surface.

DARWIN ON CONSANGUINEOUS MARRIAGES.

There are few questions in social economy which have given rise to more scientific discussion than that of the intermarriage of near relations. While some attribute to those marriages no sinister results, others, on the contrary, affirm that they are fraught with the gravest danger to society, and that the offspring are, as a rule, disposed to be lymphatics, deaf mutes, idiots, epileptics, or sufferers from some one of the maladies of the nervous systems. Various investigations have been set on foot from time to time with a view of reaching some definite data on which to base a general law, without, however, attaining the desired object. A large number of instances of marriages between first cousins were at one period collected in France, among which were some terrible examples. In a Protestant family of the Isle de Ré, three brothers married three sisters, the parties bearing the above-stated relation. Out of eighteen children, the issue of these alliances, but one was exempt from infirmity; of the others, some died young, and the rest dragged out wretched lives as idiots and invalids. On the other hand, a French physician, Dr. Bourgeois, gives a history of his own immediate family, in which there were records of seventy-four consanguineous marriages, not one of which resulted in misfortune to the descendants.

Some new investigations on this important subject have recently been undertaken by Mr. George Darwin, the son of the celebrated naturalist, and carried through in a striking and novel manner. The questions to be settled were, first: What is the rate of consanguineous to ordinary marriages in the entire English population? And second: In asylums for idiots, deaf mutes, and the blind, what is the proportion of inmates, who are the offspring of consanguineous marriages, to the total population of the institution? It is clear that, if the second ratio should exceed the first, danger in consanguineous marriages might be inferred. If, on the other hand, the ratios should appear equal, such alliances might be considered as free from harmful results.

In beginning his work, Mr. Darwin counted all the marriages announced in the *Pall Mall Gazette*, a London journal, and especially noted such as were contracted between persons of like name, regarding such as taking place between first cousins, and intending to use the data as a basis for his calculations. The objection, however, at once suggests itself that many persons have the same name but are not at all related to each other; but this Mr. Darwin foresaw, and provided for. By consulting the English census of 1853, which showed the frequency of different family names in England, he discovered, for example, that out of every seventy-two persons there is one Smith; out of every seventy-six persons, one Jones, and so on. Now by the law of probabilities, which teaches that a composite event has for probability the product of the probabilities of the events of which it is composed, the chance that one Smith marries is $\frac{1}{72}$, and the chance that he will marry another Smith, not a relative, is $\frac{1}{72} \times \frac{1}{72}$ or $\frac{1}{5184}$, evidently a faint shadow of probability. Similarly, that a Jones will marry another Jones, not a relative, the chance is $\frac{1}{6076}$. Mr. Darwin calculated these probabilities from all the well known names, and deduced from these the chances of the less common appelations. Then, by taking the sum of all the probabilities, he found that the chance of persons, of like name but of different families, contracting marriage is only about 1 in 1,000, a probability so small that he considered himself justified in neglecting it; and thus he substantiated his first assumption, above-noted, and was led to conclude that in England the proportion of marriages contracted between cousins (of any degree) of like name is about $\frac{75}{10000}$ of the marriages in general. It now remained to deduce the proportion of consanguineous marriages, when the two parties bore not merely the same but different names.

First cousins may be divided into four classes: 1. Children of fathers' brothers; 2, of fathers' sisters; 3, of mothers' brothers, and 4, of mothers' sisters. If these catelgories were all of them equal, then the ratio of cousins of like names to cousins of different names would be about $\frac{1}{3}$. Such an assumption is untenable, and very many cases can be cited where it would be impossible; therefore the investigator is compelled to resort to actual statistics. Mr. Darwin prepared questions which were answered by the members of 283 families; and from the figures thus obtained he deduced that the ratio of first cousins of the same name to first cousins of different names is about $\frac{1}{4}$. But so hypothetical a conclusion needed more direct confirmation; and therefore Mr. Darwin distributed another set of questions, in which he asked to be informed relatively to the marriages between cousins which took place among the nearest relatives of the persons addressed. The results thus obtained confirmed the first ones, and the investigator was able to affirm that the sought-for ratio is comprised between $\frac{100}{414}$ and $\frac{100}{423}$. Applying this to the proportion of marriages of the same names, as previously stated, Mr. Darwin obtains the response to his first question, namely, that in England the ratio of marriages between first cousins is between 2 and 3 per cent of all marriages occurring. Other though more limited researches, by means of genealogical works and records, confirmed the above result, and showed further that in London the ratio falls to 1½ per cent, while in the rural districts it rises to 2½ per cent. Among people in good circumstances it reaches 3½ per cent, and among the titled aristocracy attains its highest figure, 4½ per cent.

The second portion of Mr. Darwin's work consists in researches made in about twenty insane asylums, and in a number of institutions for deaf mutes and blind children. He obtained information relating to the families of 4,822 idiots; and out of this large total he found that but 170 marriages between first cousins had insane issue, or from 3 to 4 per cent of the total number. The families of 366 deaf mutes (so born) contained but 8 (or 2 per cent) marriages of first cousins. This ratio is founded on too few a number of observations to merit complete confidence; but such as it is, it is far from being unfavorable to consanguineous marriages.

This is the present extent of Mr. Darwin's labors; and the accumulation of future researches will, of course, place them in more definite shape. As far as can be now judged, it would seem that there is no such serious danger attendant upon consanguineous marriages as has been stated and popularly believed. It is a misfortune that the suggestion of Sir John Lubbock, relative to adding a question regarding consanguineous marriages to the queries to be annexed to the English census papers of 1871, was not adopted, since the statistics thus obtained would have been of great value in Mr. Darwin's hands. Mr. Darwin's investigations, however, are remarkably bold, and certainly his deductions in the beginning are ingenious. Besides, in common with all similar work, they add to our knowledge of the science which underlies the welfare of the community; for it will be evident that, should such researches eventually prove that consanguineous marriages are dangerous to posterity, it then becomes the plain duty of society, for its own preservation, if not to interdict them, at least to prevent their occurrence as much as possible.

AN ENERGETIC EMPEROR.

The Emperor of Brazil (or rather Dom Pedro de' Alcantara, as he is registered in the book of arrivals at the Fifth avenue hotel, and as he prefers to be called, seeing that he travels as a private gentleman), together with the Empress and suite, arrived in this city on Saturday, April 15, and, after a stay of some forty-eight hours, departed for San Francisco. Brief as this flying visit was, it has been amply long to demonstrate the fact that the sojourn of his majesty in this country is not going to involve a repetition of the ovations which were accorded to the Prince of Wales and the Russian Grand Duke. Not that Dom Pedro does not merit, or would not under other circumstances receive, the grandest welcome we could give him; for as a potentate he outranks both the above dignitaries, and as a man he is immeasurably their superior; but he wishes it understood that his imperial paraphernalia are all left behind in Brazil, and that here he is simply Mr. Alcantara. Therefore no one need look for a royal progress, for they will be more likely to meet his majesty ensconced in a street car, as he was the other day in the suburbs of this city, and paying his five cents fare like any other passenger.

The Emperor characteristically began his visit by promptly declining to undergo the ceremonious reception which the government had provided for him, wholly regardless of the fact that three cabinet ministers, a vice-admiral, a major general, one man of war, a tug, and a steam launch had been dispatched to convey him from the Brazilian steamer to the the city. When the high officials boarded his vessel, they found him in slouch hat and traveling garb, chatting pleasantly with a band of newspaper reporters, and their formal proceedings degenerated into a solemn farce. Dom Pedro declined to accompany them, so perforce they returned alone, and received the royal salutes thundered forth by mistaken forts and ships: while the Emperor quietly remained on board the steamer until she reached her pier, and then, with his party, hired hacks and drove to the Fifth avenue hotel. Two hours after his arrival he visited one of the principal theaters and witnessed one of Shakespeare's plays, Henry V., on his return to his hotel he received a serenade, and then, at an hour (one o'clock Sunday morning) when it might be supposed that even royalty would become sleepy and tired after the long voyage, he started off to the *Herald* office, and watched the whole process of stereotyping and printing the morning edition of the paper. The Emperors' sight-seeing capacities are certainly extraordinary. At six o'clock the same morning he was wandering over Central Park; and during the next twenty-four hours he found time to attend church, to devote two hours to being photographed, to inspect the Croton water works, to visit Messrs. Moody and Sankey's meeting at the Hippodrome, and to spend the greater part of the night curiously examining the newsboys' lodging house, a police station, and the practical workings of the fire telegraph system in an engine house. On the subsequent morning, at an equally early hour, the Emperor was driven over to Jersey city (narrowly escaping a serious accident on the way, by the collision of his vehicle with a heavy cart) and made a thorough inspection of the vicinity. He was particularly pleased with the horse car elevator which lifts the street cars bodily up the Bergen hights, and mentioned the need of such engineering works to several Brazilian towns. On his return to the city, he visited several of the public schools and two hospitals, received an address from a committee of citizens, and at 6 P. M., after declining the proffered courtesy of a special train, installed himself with a portion of his suite in a Pullman car on the Erie Railroad, and started for San Francisco. The Empress remains in this city; Dom Pedro will proceed direct to San Francisco, remain there five days, and return by way of Denver, Salt Lake city, and Chicago, in time to reach Philadelphia at the opening of the Centennial.

The remarkable energy manifested by the Emperor in this city, in acquiring the utmost information in the brief time at his disposal, typifies his whole character. He is utterly averse to ceremony of every description, and even in his own capital throws off the seclusion peculiar to royalty, and mingles with his subjects at public places without restraint. As a ruler, none has done more to benefit his country. He has abolished slavery in his dominions, built railroads, successfully carried on great internal improvements, consolidated

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his government,and raised Brazil to a position of undisputed pre-eminence on the South American continent. As a man, Dom Pedro possesses great literary and scientific acquirements. He was a warm friend of Agassiz, and rendered that naturalist invaluable aid in his studies on the Amazon; he is a member of the French Academy of Sciences, and for many years has been a reader of the SCIENTIFIC AMERICAN. His ideas on scientific subjects are broadly liberal. To a correspondent on board the vessel coming from Rio Janeiro, while discussing Darwin's theory, he said: "The theory advanced by Darwin is undeniable, but I do not agree with the deductions of some of Darwin's followers. I often recommend our young men to read Darwin's work, because I am a partisan of truth; and the more I read the more I am convinced that all truth is one, and that all Science meets in the point of truth. Therefore no obstacle should be thrown in the way of the development of any science." With such an advocate in the cause of Science, progress and enlightenment in Brazil will make rapid strides.

In conclusion we desire especially to bespeak for the Emperor a warm welcome from the scientific and progressive people of our land. And that welcome, we ask, shall not be meaningless displays or ovations, but the careful exhibition and explanation to his majesty of all industrial operations, of all new machinery,and all engineering and mining works which he may encounter in his journey. We can assure inventors, mechanics, engineers, and all scientific men that they will meet a most appreciative and eager listener, one who is well informed as to what American genius has already accomplished, and beyond all a man who discards the name of Emperor for the self imposed title of student.

SELF--IMPROVEMENT.

There are many young working men who are anxious to improve their minds by reading and study out of business hours. But too many grow discouraged and fail in their efforts for self-improvement, although they begin with the best intentions.

A want of thoroughness in whatever is undertaken is, perhaps, one great cause of such failures. A practical writer on that topic gives the following good direction: "Never leave what you undertake to learn until you can reach your arms around it, and clench your hands on the other side." It is not the amount of reading you run over that will ever make you learned; it is the amount you retain. Dr. Abernethy maintained that "there was a point of saturation in his mind," beyond which it was not capable of taking in more. Whatever was pressed upon it afterwards crowded out something else. It is probable that few of us have minds more sponge like than that of the great doctor.

Every young man should endeavor to perfect himself in the science of the business he has chosen. Without this, he must always content himself in the lower walks of his calling. The cost of a few cigars will buy all the books he requires, and his own diligence may be made to well supply the place of a tutor. Without such diligence, the best teacher in the world could not manufacture him into a scholar. If once going over a point will not master it, he must tackle it again. Better give a week's study to a page than conclude that you cannot comprehend it.

But though it is wise to give your main strength to your own specialty, you should not confine yourself to such studies exclusively. The perfection of all your powers should be your aspiration. Those who can only think or talk on one subject may be efficient in their line; but they are not agreeable members of society in any of its departments. Neither have they made the most of themselves. They become one sided and narrow in their views, and are reduced to a humiliating dependence on one branch of industry. It costs nothing to carry knowledge; and in times like these, to be able to put his hand to more than one branch of industry often serves a man a good turn.

Do not attempt too much in the way of study to begin with; you will surely lose heart if you do. Be humble and modest in your aspirations, and if you are diligent never fear but that you will hear a voice saying: "Come up higher." Be content to gather the precious gold of learning grain by grain; you will soon be able to see the pile growing, and will learn from it the wonderful power of the littles, which is felt and shown in mental as well as in golden gains.

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

It is a curious circumstance that, while the government of the United States has, at an enormous expense, undertaken the removal of the Hell Gate rocks from our East river, it has at the same time given its formal sanction, through the Secretary of War, to the erection of new impediments to navigation on the same river, at a point only a short distance from the firstnamed obstructions. We allude to the suspension bridge over the East river, between New York and Brooklyn. In our paper for August 7, 1869, Vol. XXI, page 85, we gave a diagram showing the elevation of the intended bridge; and public attention was called to the fact that,unless the level were fixed higher,it would seriously obstruct the navigation of the river. But no notice was taken of the matter by our shipping merchants, and the construction has gone steadily forward until the towers are almost ready for the stretching of the wire cables. A vigorous protest is now in circulation by prominent citizens, who are making an effort to have the level of the bridge altered or the work stopped.

They aver "that the Brooklyn bridge will, if completed, inflict almost incalculable damage to the commerce of this port by preventing the passage of sparred vessels of any considerable size, as the hight of the roadway at the towers will be 115 feet, and the center of the span will be only 135 feet above high water mark, while the masts of ships and barks vary in hight from 150 to over 200 feet. The petitioners also state that subscriptions are now being made by the citizens of New York, with a view of legally contesting the right of the Secretary of War to authorize the erection of the bridge, believing it to be at variance with the spirit of the Constitution of the United States, and in non conformity with the acts of Congress."

The principal objection to the raising of the level is the additional expense, and the increased grade of the approaches to the bridge. But these are minor considerations, compared with the importance of preserving unimpaired the splendid water way now existing, which will be still more necessary to commerce when the Hell Gate and Harlem river improvements are completed.

We give in our this week's SUPPLEMENT views of the great towers of the bridge, with particulars and dimensions of the various parts. We also give an engraving and description of the new drawbridge proposed for the Thames river at London. It will be seen that the Brooklyn Suspension Bridge,even if carried out on the present level,will be a very small obstruction to navigation as compared with the proposed London structure.

OPENING OF A REMARKABLE RAILWAY IN LONDON.

The London papers announce a further extension of rapid transit in that city by the completion and opening for public traffic, on April 5, of the East London Railway, which is another of those gigantic underground enterprises for which the metropolis of England is so distinguished. The most remarkable feature of this new work is the fact that a considerable portion of the line is built under water. The commerce of the world may be said to float and navigate directly over a part of the roof of the tunnel, which extends south easterly,from the Liverpool street station of the Great Eastern Railway, passing directly under the warehouses and water basin of the London Docks, thence under the embankment, across and under the Thames river, to the New Cross station of the Southeastern Railway, thus connecting all the roads named, and also the London and Brighton and South London lines. At Shadwell and Whitechapel, magnificent stations, each four hundred and fifty feet in length,have been erected. The total cost of this new line, which is a little less than six miles in length, has been £3,200,000, or sixteen millions of dollars. Of the advantageous nature of this line to the public, the London papers say there is no doubt. That portion of the line under the Thames passes through the old Thames tunnel, built by the celebrated engineer M. I. Brunel. This work was commenced in 1824, and opened for foot passengers in 1843, but never proved of much value to the public until brought into use several years ago as a railway tunnel. The masonry comprising this remarkable work is 38 feet wide and 22½ feet high, and was carried across underneath the bed of the river by means of a great shield, within which the masonry heading was erected, and the shield then pushed ahead step by step, by jack screws, the masonry being built up as fast as the shield advanced.

ARTIFICIAL EYES MADE SENSITIVE TO LIGHT.

Among the curious developments of Science is the recent production, by Dr C. W. Siemens, of an artificial eye that is sensitive to light. We wish we could add that it gives vision to the blind; but we cannot, though perhaps it contains a germ of promise in that direction. The new eye is composed of an ordinary glass lens, backed by an artificial retina of selenium. This mineral resembles and is allied to sulphur; it is distilled from bodies that contain sulphur in conjunction with metals, such as iron pyrites, a compound of sulphur and iron.

Mr. May, a telegraph clerk employed at the Valentia station of the Atlantic cable line, first observed, in 1873, that the electrical resistance of selenium was instantly altered by light, the resistance being diminished by increase of light.

Dr. Siemens makes use of this peculiarity of selenium in the construction of his novel eye. An electrical circuit is arranged, of which a bit of selenium forms a part, and constitutes the retina. When a strong light is admitted into the lens and falls upon the selenium retina, the current of electricity flows (and by acting upon small magnets) may be made to work the artificial lids of the eye, opening or closing them according to the intensity of the light.

It is well known that the vibrations of musical sounds may, by an ordinary conducting wire, be electrically transmitted and successfully delivered to the ear. It remains to be determined whether light vibrations can, by means of selenium and electricity, be transmitted to the brain in the absence of the natural eye.

THE WOODBURY PLANER WAR.

The contest between the Woodbury Patent Planer Company and the manufacturers and users of woodworking machinery continues with undiminished acrimony. The former seem to be leaving no means untried to compel the payment of an unjust royalty for the use of the pressure bar from people who have undisturbedly employed that attachment on their planing machines for many years, while numbers of the latter have organized defense associations, banded together to resist the extortion to the last. The most recent tactics of the Woodbury people,if we may credit the assertions of the Northwestern *Mechanical Journal*, the organ of the Northwestern Planing and Molding Machine Association representing some 300 machines, is to avoid the consolidations and confine their offensive efforts to individuals not included in the membership. The associations are wealthy; and can afford to fight the aggressors for any length of time, but on the other hand few isolated concerns would care to undertake a conflict with the Planer Company, when a sum comparatively small to that which defending an expensive lawsuit would cost them, would secure their immunity. Of course yielding to the demand would be a sacrifice of principle and a submission to the superior force, but on the other hand there are scores of small manufacturers who care nothing for either side of the controversy and would willingly keep themselves and their business clear of it. The Woodbury Company are evidently aware of this fact, and therefore naturally prefer bringing their forces to bear upon isolated opponents rather than upon members belonging to associations likely to prove powerful antagonists. Even if this course has no better results, it is probable that it may secure to the company the means of existence until a decision of the courts settles the question definitely. Obviously the present work of the Association is to strengthen their memberships, otherwise it may be found that the present tactics of the Woodbury people, so far from being a sign of weakening on their part, as our abovementioned contemporary intimates, are likely to work more harm than the open system of attack which they have abandoned.

THE LOUGHBRIDGE AIR BRAKE.

The use of the air brake has for many years been persistently advocated by Mr. William Loughbridge, of Baltimore Md., who ranks among the earliest inventors and patentees in this line. To some extent others have obtained laurels that were in strict justice his due. Recent trials upon the Baltimore and Ohio Railroad appear to have practically established the superiority of his devices.

On one of these occasions a train of ten cars, drawn at the highest attainable speed, by the best engine owned by the company, was brought to a stop, from a velocity of 42 61 miles per hour, within a distance of 590 feet, in 16 seconds time. This, we believe, beats anything heretofore accomplished, either in this country or England. The following are the particulars:

EXPERIMENT WITH LOUGHRIDGE AIR BRAKE, AS TRIED ON WASHINGTON BRANCH, B. & O. R, BETWEEN BRANCHVILLE AND ALEXANDRIA JUNCTION, 1876.

No. of engine	323
Direction of movement	southward.
Weight of engine	76,700 lbs.
Weight of tender	38,370 "
Average weight of cars	37,608 "
Total weight of train	245 1150-2240 tuns
No. engine driving wheels	4
Diameter engine driving wheels	69 inches.
Size of engine cylinder	17x24 "
Size of air cylinders under cars	11x11½ "
No. of cars	10
Total length of train	635 feet
Total number of wheels in train	96
No. of wheels to which brakes were applied	92
State of steam gage at start	130 lbs.
" " " on shutting off	120 "
" " " when train stopped	125 "
" air gage at start	60 "
" " at time of applying brakes	80 "
" " when train stopped	50 "
Distance run for speed	12,180 feet.
Time consumed in running last 1,000 feet before shutting off	16 seconds.
Distance run after shutting off steam before applying brakes	300 feet.
Speed of train when brakes were applied	42·61m. per h.
Time occupied in making stop	16 seconds.

REMARKABLE OCEAN STEAMING.

The recent voyage of the Pacific Mail Steamer Company's new steamer City of New York, from this port to San Francisco, was in some respects remarkable. The total distance, 13,552 miles, was performed in 59 days, the actual steaming time being 54 days 14 hours The entire passage was made on the coal shipped at New York,none having been taken on board *en route*. The runs made were as follows:

New York to Cape Virgin, west entrance of the Straits of Magellan	7,074 miles.
Through the Straits	340 "
Cape Pillar, east entrance of Straits of Magellan, to San Francisco	6,138 "
	13,552 "

Prior to the famous first trips between England and New York, of the steamers Sirius and Great Western, in 1838, when the subject of ocean steam navigation was under discussion in England, Dr. Dionysius Lardner predicted that steamers could not be run with commercial success across the Atlantic until the consumption of fuel was reduced, as the cost and bulk of coal would eat up all profit. And he was right. For over twenty years after the opening of the Cunard line in 1840, it required the payment of enormous special subsidies by the governments, in order to make good the losses to owners. First class steamers between New York and Liverpool consumed nearly 100 tuns of coal a day. The largest vessels now only require about one fourth the above fuel, and are also in other respects more economical than formerly. The following are some of the particulars of the City of New York's voyage;

Total revolutions of the engines	3,338,105
" distance by observation	13,552 miles.
" distance by screw	14,235 "
" amount of coal consumed (dock to dock)	1,495 tuns.
Total amount of coal consumed at anchor (port consumption)	45 "
Total amount of coal consumed for steaming	1,440 "
Average consumption of coal per day	26·4 "
" " " mile	239 lbs.
" revolution per day, running time	61,250
" " minute	42·53
" speed per day, running time	248⅛ miles.

The dimensions of the City of New York are as follows: Length 353 feet, beam 40½ feet, tunnage 3,019. Engines 1,000 horse power.

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Continued from first page.)

the boiler, (Fig. 5). The cylinder is 2 inches in diameter and has 2¼ inches stroke of piston. It is supplied with all the attachments used in large engines, the governor being inside the belt pulley, and operating directly on the point of cut-off, enabling a small amount of steam to do a large amount of work. The engine is ready to work in ten minutes from lighting the gas, and will run all day without any attention whatever. With a supply of gas and water, it is its own engineer and fireman. It is admirably adapted to the use of dentists, jewelers, tea merchants, and amateurs.

These engines were patented by Hiram S. Maxim, of New York city, December 22, 1874, and July 20, 1875. The engravings accompanying this article were photographed on the wood from Mr. Maxim's drawings, and represent the parts of the engine as they actually exist.

These engines are manufactured in six sizes, varying from 2 horse power downward, by Messrs. Maxim & Welch, of 176 Center street, New York city, who may be addressed for further particulars.

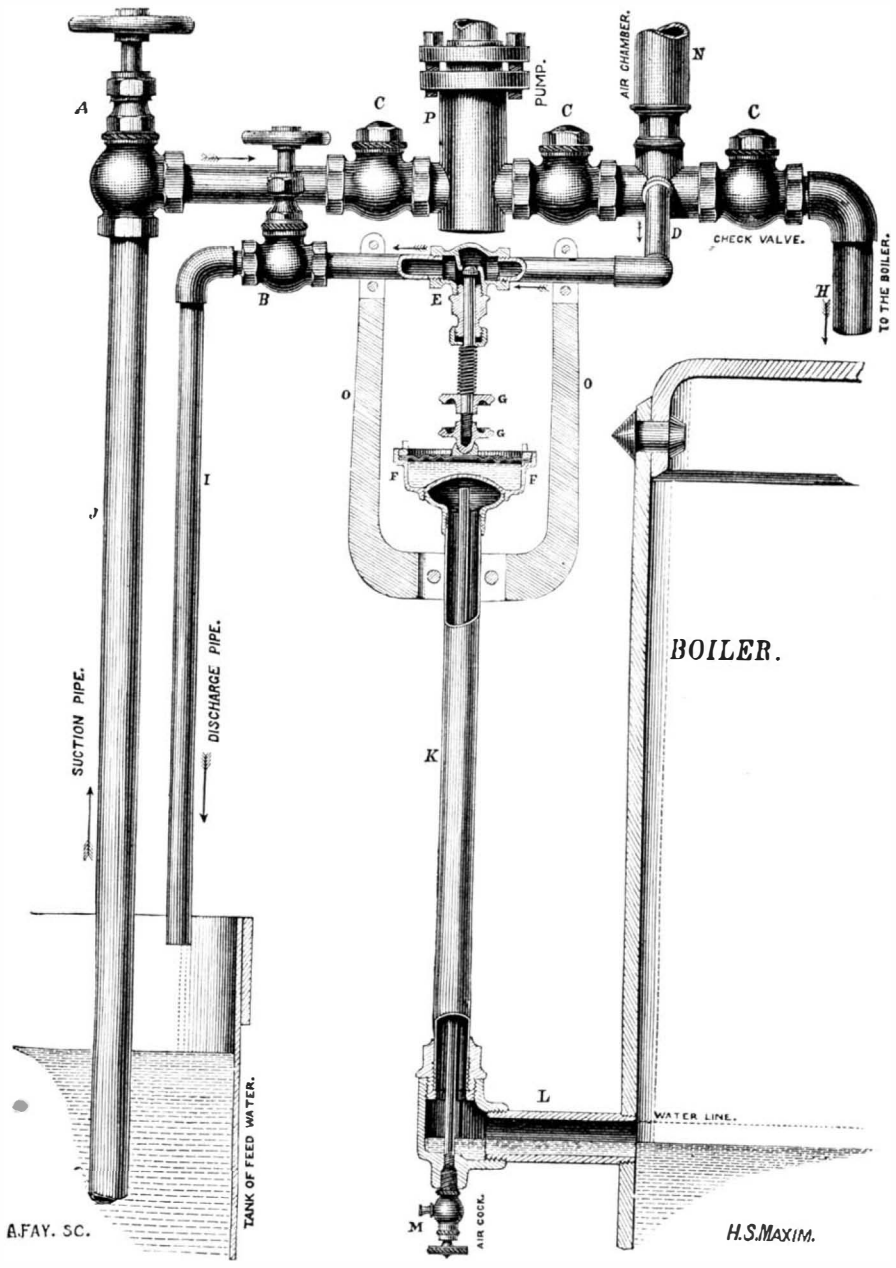

Fig. 3.—MAXIM'S AUTOMATIC ENGINE FEED PUMP.

How it Happened.

The following explanation was recently given by an English bankrupt to his creditors. We find the account in the London *Grocer*. It is rather unusual for such unfortunate men in business here to take the trouble to explain the calamity in the candid manner which the English tradesman adopts towards his creditors. The statement bears upon its face truthfulness, and it is to be hoped that his friends accepted his statement and afforded him credit:

"Gentlemen; The fact of my having stopped payment being known to you, I wish to lay before you some of the reasons for doing so. I came into this business, as is well known, under very great disadvantages, the premises being in a very dirty and dilapidated state, connection gone, with the exception of a sprinkling of ready money and the tail end of an unsound booking trade; and on using every effort to get the thing in working order and recover the connection, I am, so to speak, for the moment come to the ground. When I came in I paid to the trustees of Nicholson's estate $4,350, $2,825 of which was for a drained out stock, $350 for horse, van, etc., not worth at the outside $125, having sold the horse for $35; trade utensils $150, consisting only of five counter scales, there not being a scoop or any other utensil in the place (which to a business man seems almost incredible, but such was the fact, so utterly had the thing throughout become a wreck); not even a canister for tea or coffee fit for use, or drawers in counter; also not a tap to draw treacle from, my predecessor usually knocking out the head of the cask and dipping it out with a biscuit tin: $1,050 for goodwill and fixtures not worth $200. You will thus see the disadvantages under which I came in. Add to this $225 for valuation and introduction to the business, and $105 paid Nicholson for house fittings, etc., removing furniture $125, thus making altogether nearly $5,000 before I could make a start; and finding the place in such an unworkable state, my preliminary and working expenses have of course been exceedingly heavy. I need not to have stopped, as I had the entire confidence of my creditors, but on taking stock found that my position was not satisfactory, and deemed it prudent, rather than abuse the confidence of my creditors, to stop payment at once, which I did immediately. You are, doubtless, aware that I left a firm of high standing (after being with them sixteen years, fourteen and a half of which I had the entire management and buying of their grocery department, the returns of which were large) to come here, working day and night under great mental anxiety, being of a naturally high, nervous temperament, and now find myself utterly ruined. I came here, saw, and in some unaccountable manner was, so to speak, captivated; I rushed into it without legal or private advice on my part, and the result would be, were I to go out now, without further expense in getting rid of all assets, that I should leave behind between $5,500 and $6,000: this through no fault (as is well known, except the fact of my coming here) of my own, but my misfortune.

"As one of the disadvantages which have to encounter, I must not forget to mention the fact of my predecessor (who had been here for years underselling everyone, thereby gaining popularity) having again re-opened premises just below me, and of course, as a natural consequence, taking part of his old connection, thus weakening the already drained out wreck."

FOR mending valuable glass objects which would be disfigured by common cement, chrome cement may be used. This is a mixture of 5 parts gelatin to 1 of a solution of acid chromate of lime. The broken edges are covered with this, pressed together, and exposed to sunlight, the effect of the latter being to render the compound insoluble even in boiling water.

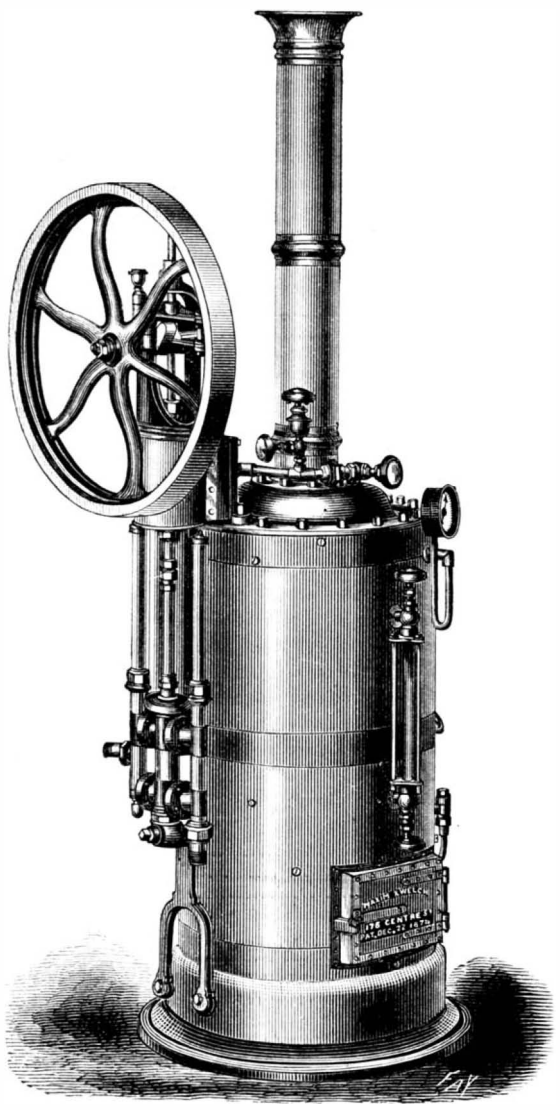

Fig. 4.—PUMPING ENGINE.

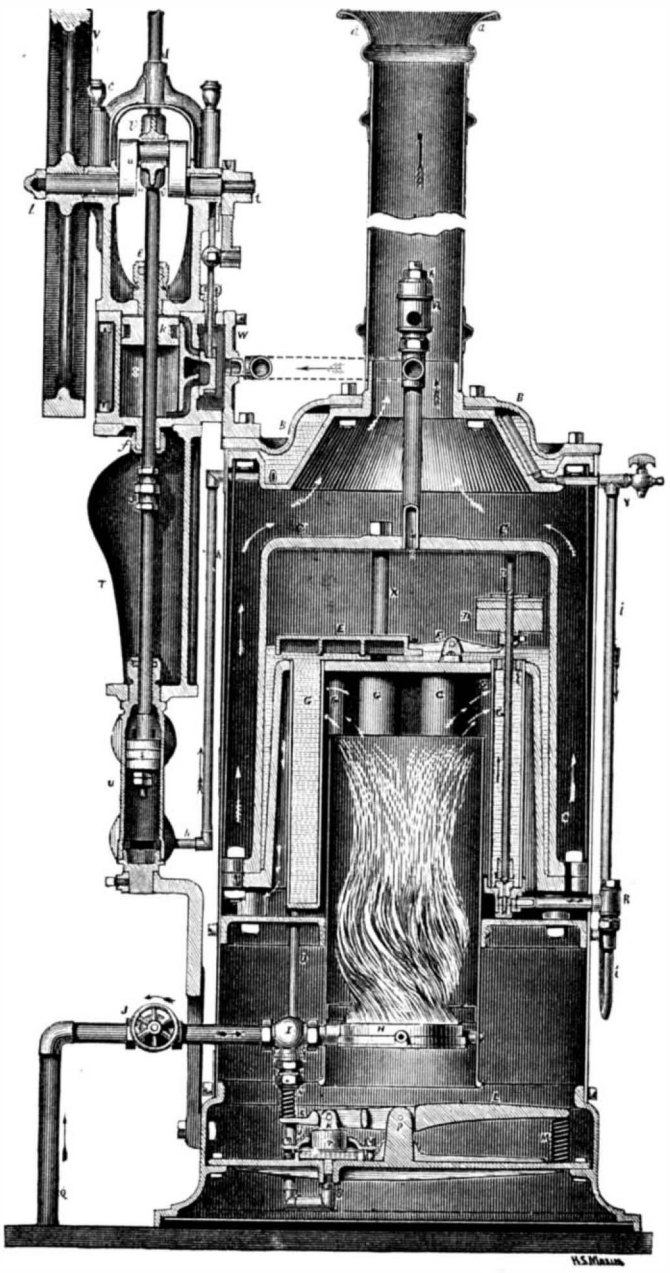

Fig. 5.—SECTION OF PUMPING ENGINE.

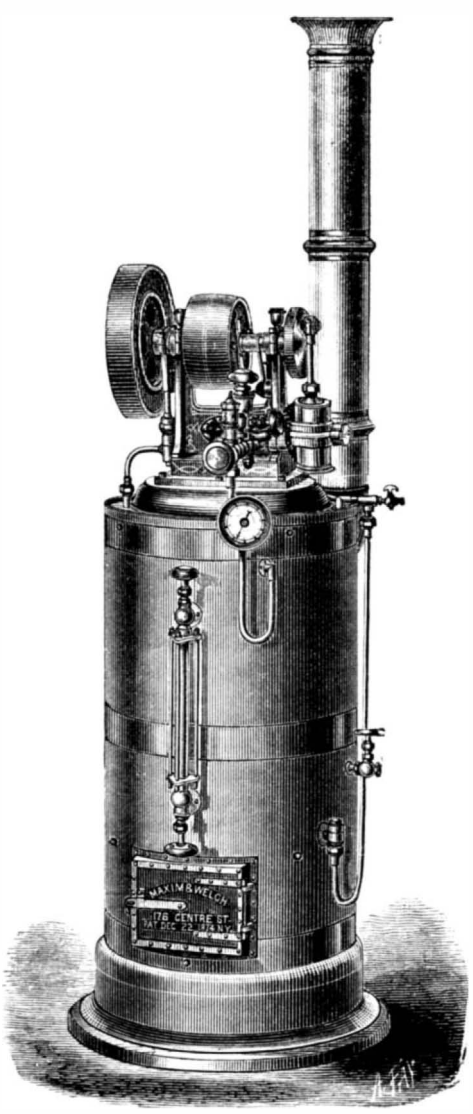

Fig. 6.—OSCILLATING ENGINE.

MAXIM'S AUTOMATIC STEAM ENGINE.

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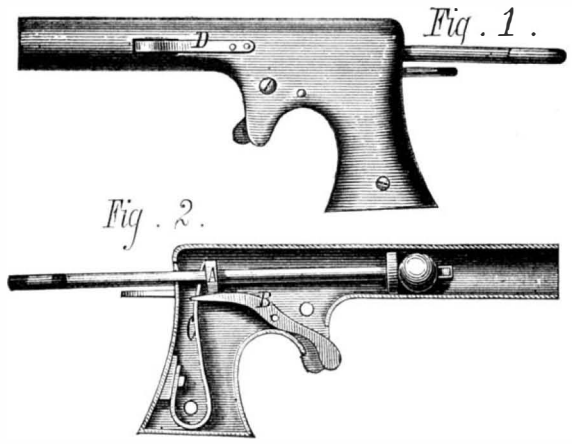
IMPROVED TOY PISTOL—MECHANICAL MARBLE PLAYING.

This is a new way of playing marbles, which we have no doubt will greatly please the boys. Instead of holding the marble between thumb and finger, and propelling it in the somewhat disadvantageous position of "knuckling down," the inventor of the present device proposes to shoot it out of a spring pistol. This change, he thinks, will increase the sport and add to the enjoyment of the game.

The construction of the pistol is represented in the annexed engravings, Fig. 1 showing an exterior, and Fig. 2 a sectional view. The stock is made of metal, in two sections, and is held together by screws. The piston rod carries a disk, A, which rests against the trigger, B. Also on the



piston rod is a shoulder which, when the rod is drawn back against the spring, C, which bears against disk, A, catches on the handle plate, as shown in Fig. 2. The marble is prevented from rolling out when the piston is aimed downward by the side spring, D. By pressing on the trigger the piston rod is raised so that its shoulder no longer engages with the handle plate, when it is pushed forward by the spring, C, thus throwing out the marble.

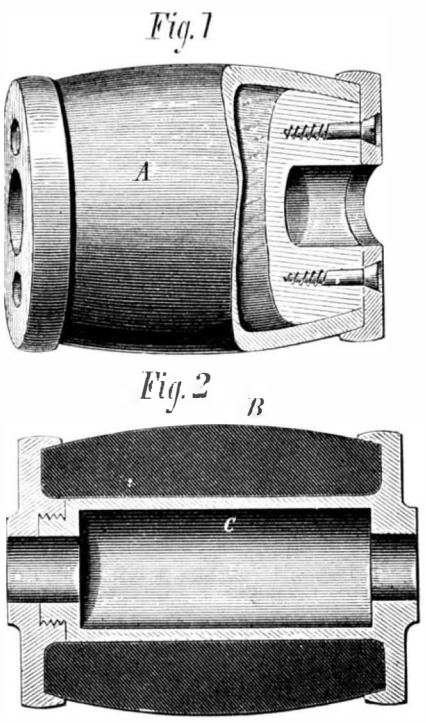
Patented through the Scientific American Patent Agency, February 29, 1876. For further information relative to sale of rights, royalties, etc., address (until May 20 next) the inventor, Mr. O. C. Butterweck, Newcastle, Lawrence county, Pa.

HEER'S DRIVING PULLEY.

The invention represented in the annexed engravings is a new driving pulley, provided with an india rubber surface, the object being to gain lightness in weight and effectually to prevent the belt from slipping or leaving the pulley. It is claimed to be especially adapted to the spindles of circular saws and lathes, to the shafts of planing machine cutters, and to other shafts which have to revolve at a high rate of speed. The engravings represent two different forms of the invention.

In Fig. 1 a block of wood is turned nearly to the size of the required pulley, and larger at the diameter at the middle. To this is fitted a short rubber tube, A, which very tightly embraces it. The ends of the tube are confined to the block by flanges of the end plates, which are secured by ordinary wood screws, as shown. A hole is then bored through the block for the shaft, and a slot is formed for the securing key.

In Fig. 2 the block B, is made wholly of rubber, and one of the end plates has a hub, C, extending entirely through. On the end of the hub a thread is cut, and on this the opposite plate screws, so as to confine the rubber tightly. In this case the hub may be furnished with ribs adapted to recesses n the rubber block to prevent the latter turning; in the pre-



ceding form this precaution is unnecessary, as the rubber tube adheres with sufficient firmness to the wood. The device, we learn, has been successfully tested.

Patented February 29, 1876 For further information address the inventor, Mr. David Heer, care of H. D. Hirst, 1,126 Charlotte street, Philadelphia, Pa.

Mechanics should Read and Reflect.

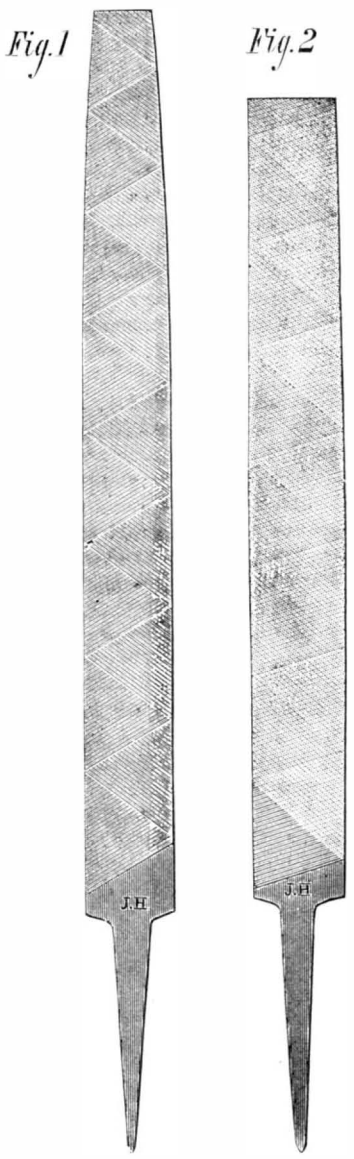
The young mechanic of the present day should be an earnest reader. Whether learning a trade, operating a machine, or drafting designs for the builder, he should be a lover of useful books. They will serve as an adjunct to his success. They will make him a broader and happier man, giving him continually fresh themes for thought and pleasing topics for meditation. Books are to the mind what food is to the body. They fill and strengthen it. They add vim, force, and vitality to its every function. They furnish that life blood which is the main spring of all action; and benefit their admirer in manifold ways. Do not then neglect so rich a boon. But read much and read carefully.

We cannot all be rich, or great, or powerful; but we can all build for ourselves inviting palaces of wisdom, where the noblest and best of every age may come through the silent but immortal agency of books, to store our minds with the rarest samples of their genius. These choice legacies, too, will stand by us, and remain with us, when trades, fortunes, and friends fail, to comfort and satisfy our drooping spirits. Who then would think of living without the association of interesting books? No young man should.

The world is full of reading matter, and it is utterly impossible to peruse all; still every apprentice and tradesman can find leisure enough to acquaint himself with so much as is necessary to perfect him as a mechanic and broaden him out as a citizen. Read, then, by all means. Read slowly; read carefully; read with reflection; and reflect with reading.—*Northwestern Lumberman.*

HAPTONSTALL'S DIAMOND FILE.

The annexed illustrations represent a new mode of cutting files, Fig. 1 being a single cut, and Fig. 2 a double cut tool.



The abrading surface is formed by two series of diagonal teeth arranged in alternate sections and at relatively opposite angles. This is clearly shown in the engravings. The advantages claimed are that both single and double files cut much smoother than those made in the usual way, and that they are not liable to choke, so that they operate faster and last much longer than is commonly the case. The files run square across the stock and are intended to be used in that way. The inventor states that the single cut file is especially adapted to woodwork, as the reversed angles allow the escape of the dust in both directions. A gun file is made on the same principle, oval in form to suit the inside of the gun barrel.

Patented August 17, 1875. For further information relative to sale of patent or of rights, address J. & J. S. Haptonstall, Adel, Iowa.

The Effect of Cold on Milk.

The *Lancet* says that the effects of a low temperature on milk have been carefully examined by M. Eugène Tisseraud, who recently communicated his observations to the Academy of Sciences. He found that if cow's milk is, immediately or soon after being drawn, placed in vessels at various temperatures between freezing point and 90° Fah., and the initial temperature is maintained for twenty-four or thirty-six hours, it will be found that, the nearer the temperature of the milk is to freezing point, the more rapid is the collection of cream, the more considerable is the quantity of cream, the amount of butter is greater, and the skimmed milk, the butter, and the cheese are of better quality. These facts, he believes, may be explained by Pasteur's observations on ferments and their effect on the media in which they live. It is probable that the refrigeration arrests the evolution of the living organisms which set up fermentation, and hinders the changes which are due to their growth.

NASH'S LIFE-PRESERVING STOOL.

The annexed engraving represents a new life-preserving stool which, if employed aboard vessels, would doubtless

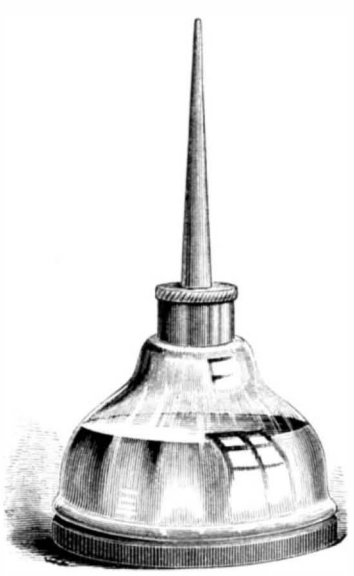
greatly add to the security of passengers. Experience has amply demonstrated that life preservers, not merely when they are stowed away, but even when prominently exhibited about decks, are too frequently overlooked in the confusion of sudden disaster; and being secured in place, in case of the ship sinking, they are carried down with her, and thus become of less use than hen coops, skylight covers, or other movable buoyant articles. The present inventor has conceived the excellent idea of converting the ordinary furniture of the vessel into life preservers. He simply provides stools with cork seats, as shown in the illustration.

Two disks of cork are fastened upon a base board, another board is placed over them, and the whole is bolted together. There is no air chamber to become punctured and therefore useless, and the cork will always float and support persons clinging to the stool. The cork seat is of course applicable to chairs and all loose pieces of furniture, and thus articles always ready at hand are converted into efficient devices for saving life. The invention might be applied to the long settees used in the cabins of ocean steamers, so that three or four of these lashed together would form an admirable raft, which could be rigged in half the time required to make one of spars. There is nothing costly about the plan. We consider it an excellent idea, and one well worth the notice of owners of vessels of all kinds.

Patented through the Scientific American Patent Agency, October 5, 1875. For further information relative to sale of rights, etc., address the inventor, Mr. Henry H. Nash, 223 South Eutaw street, Baltimore, Md.

BACKUS' IMPROVED OIL CAN.

The novel feature in the oil can illustrated herewith, and on which the patent is based, is the glass body, a point of advantage which can hardly fail to be appreciated. It admits of seeing exactly how much oil is contained at any time, and also of noting when the oil becomes dirty or gummy. The device is especially adapted for use with sewing machines, since it will save frequent refilling of the can by guesswork, and the consequent danger of greasing clothes and carpet. The



bottom and nozzle are of metal, the former attached around a bead and fastened by cement introduced inside, so as to form a neat and strong joint. The nozzle is a solid, durable piece of Britannia metal, easily straightened if bent, and attached to the can by a screw thread on the glass. The glass is thick and amply strong to resist breakage by any ordinary fall, and it is easily cleansed, and of course it is not subject to corrosion

For further information address the manufacturers, Messrs. Backus & Co., cor. Wright st. and Avenue A, Newark, N. J

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THE CORAL ISLANDS.---THEIR NATURE, GROWTH, AND GEOGRAPHICAL DISTRIBUTION.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY BY PROFESSOR A. GUYOT, OF PRINCETON, N. J.

In asking his hearers to accompany him on a sailing excursion, notwithstanding the stormy weather outside, the lecturer assured them that they would be most likely to encounter a calm sea and fair weather on the magnificent waters of the Pacific ocean, with its thousands of islands far away from any coast. Those who are familiar with the glowing narrations of Captain Cook and other navigators will remember that the presence of an island is recognized, long before it becomes visible, by clouds directly above it in the otherwise clear sky. The land absorbs the heat of the sun and accumulates it faster than the water; soon an ascending current of warm air is formed, carrying up moisture into the colder regions of the atmosphere, where it is condensed and forms clouds. A similar phenomenon is observed in our western plains, where the sky is frequently clear early in the morning; but by 10 or 11 o'clock enough heat has been accumulated to cause the formation of clouds.

The islands of the Pacific are of two kinds, called the lower and the higher. The lower rise but 7, 10, and rarely as high as 100, feet above the level of the sea; while the higher islands reach an elevation of 10,000, 12,000, and even 15,000 feet. There is no transition between them. The most remarkable are the lower islands. Their appearance is very peculiar. In the first place, the eye is arrested by a white beach: then comes a line of verdure, due to tropical trees; then a lagoon of quiet water of a whitish or a yellowish color, then another line of verdure, and finally, beyond all, the dark blue waves of the ocean. A picture of Whitsuntide Island illustrated the structure. It is a ring rising 7 or 8 feet above the sea level, enclosing a lagoon, and presenting the characteristics just described. The lagoon inside is but a few fathoms deep; but on the outside of the island, the water is 15,000 feet deep. Here then we evidently have a tower-like structure reaching up from the bottom of the sea, and having a depression in its summit. Some of these lower islands are 50 miles across, but most of them are not so large In some the ring is broken at several points, and these are designated by the Malay word *atoll*.

The island of Tahiti, the principal one of the Society Islands, is a good example of the second class or higher islands. It rises 7,000 to 8,000 feet above the level of the sea, has no lagoon in its center, but a crater, and the water around it is very deep. It may in fact be considered as a mountain rising to a hight of some 18,000 feet from the bottom of the sea Outside of it is a double girdle of low islands, one near, which Darwin calls a fringing reef, and one further out, to which he gives the name of a barrier reef.

On examining these reefs and the lower islands, their structure will be found made up entirely of animal remains, generation after generation having left their homes, consisting of limestone, to accumulate there. On the top we find these animals living and growing, in all colors, shapes, and sizes. The higher islands, on the contrary, except those near the continent, like Borneo, Sumatra, etc., are entirely volcanic, and do not contain sandstone, granite, or gneiss, like the mountains of the continent.

The limestone of the lower islands is not due to sedimentary deposits from the ocean, but is the work of the coral animal, the great architect of the sea. According to Agassiz's description, which is here followed, these animals are but a sac, like the finger of a glove, only more leathery. Around the mouth is a series of tentacles, formed by a prolongation of the skin. They are all skin, in fact, and have no special organs, yet they digest food with tremendous rapidity, absorbing it directly. It makes no difference if you turn them inside out; they will digest just as well as before. You cannot kill them by dividing them; for they live all over, like a plant. For this reason they have been called zoöphytes. If you cut one into eight parts, each part will live and set up in business for itself. Like all other animals, however, they grow out of eggs. The eggs are formed within the skin, which is double, and divided into cells by partitions or septa. When mature, they detach themselves, move about in the water until they find a favorable place, and then establish a new colony. They do not contribute to the growth of their parent colony, which is effected in another way.

On examining a piece of coal, it is seen to be full of little holes, popularly supposed to be the places for the stomachs of the animals, but this is not so at all; the coral animal does not form a secretion around it like the mollusks, but inside, between the two folds of its skin. Coral is, therefore, the bones and not the skull of the animal. As before stated, these animals work in societies or colonies, and their tendency is to repeat the forms peculiar to each species; thus we have corals shaped like a hand, like the branches of trees, like mushrooms, like a brain, with its convolutions. They grow and multiply in these societies by budding or gemmation. The side of the animal begins to bulge out, and the protuberance so formed develops into a new mouth, which soon eats and digests for itself, but does not separate from its parent. This process goes on symmetrically, and produces the variety of regular shapes just described.

Some distance below the surface, we no longer find these beautiful shapes, but a dense, solid, coral rock. Take for instance the coral reefs of Florida. Beginning 120 feet below the surface, we first find about 30 feet of massive rock, then the astræa, then the meandrina, and about ten feet below the surface the palmata or hand-shaped coral. In the shallow mud between the reefs and the continent, there are multitudes of branching corals of the most beautiful forms, colors, and delicacy of structure. The production of coral rock is explained partly by the mechanical action of the waves, and partly by the destruction of the coral insect by the sea urchin and other animals that feed on it. The waves disintegrate the structure formed by the animal, and then roll back the coral sand thus produced upon it, where it undergoes a process of induration in the course of time.

It is an interesting question how the structure ever rises above the water level, seeing that the animal which makes it cannot live out of the water. The little architects retain enough sea water to last them over until the next tide and are so enabled to work up to the highest watermark. Actinia have been observed all closed up on the rock at low water, and then suddenly opened like magnificent flowers, 5 and 6 inches in diameter, when the tide rose.

The ring form of the Pacific islands is due to the shape of the foundation upon which the coral animals built. On the Florida coast the reefs run parallel to the land for the same reason. Now take this, together with the fact that all the high islands are volcanoes, with the regular conical shape, and you will be prepared to understand the explanation, given simultaneously by Darwin and Dana, that the low islands were originally reefs around the high islands or volcanoes, and that the latter, by the gradual subsidence of the ocean bed, sank and left the reefs appear as low islands, with a lagoon where the crater of the volcano was. The reefs, of course, were gradually carried down along with the mountain upon the sides of which they rested, but the coral insects kept on building towards the surface; the mountain appeared as a smaller and smaller cone in the center; what was left a fringing reef now became a barrier reef, and the mountain finally disappeared altogether. This theory is supported by the fact that barrier reefs are found extending 1,700 feet down, while the coral insect cannot live at a depth greater than 120 feet. These facts were illustrated by fine pictures of the island of Bolabola and others, in different stages of the process of subsidence.

The vegetation on the islands is due partly to seeds floating in the sea, and partly to seeds dropped by birds. Hence there are very few species of trees and plants; but being in the tropics, they flourish luxuriantly.

At present, the coral formations are confined to the tropics, because the coral animal cannot exist where the temperature falls below 60°. Dana states that the central axis of the Pacific Ocean is subsiding altogether; it has already gone down more than any other part of the ocean. There are now no islands at all above the water along its line.

In old geological times, the temperature of the earth must have been much more uniform; for we find coral formations very abundantly in nearly all parts of the world. Other limestone formations are formed by a yet lower form of animal, a protozoön, which works at the bottom of the sea and thus covers nearly three quarters of the whole surface of the globe. A diagram was exhibited, showing what the microscope revealed to Ehrenberg in a piece of chalk.

Surely then, concluded the lecturer, if so great a portion of the earth's crust is the product of animal life, we must correct our notions of matter and force, and admire the beauty and simplicity of the economy of God, who makes the most insignificant of creatures subservient to his great works.

C. H. K.

THE NATIONAL ACADEMY OF SCIENCES.

The spring meeting of the National Academy of Sciences opened at the Smithsonian Institute, in Washington, on April 17. There is a strong attendance of the most eminent of our scientists; and judging from the papers which have been read up to the time this issue goes to press, the session is likely to prove an interesting and instructive one. Copious abstracts of the various communications will be found in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 20; and therefore we give in this place put a brief *resumé* of the more important ones presented. That indefatigable investigator, Professor A. M. Mayer, of the Stevens Institute, opened the proceedings with a paper on tuning forks, which instruments are now largely used for determining short periods of time by means of apparatus involving their vibrations. These researches are vitiated by errors, regarding which little is known; and although instruments have been constructed to indicate the exact measure of time taken by the forks for their vibration, such apparatus has not been accurate. Professor Mayer's new instrument involves a clock pendulum which, at the lowest point of its path, touches a mercury globule, and so completes an electric current to a fork which describes a wave line on a revolving cylinder, covered with smoked paper. When the electric spark passes, it goes through the paper. Thus the length of time between the beats of the pendulum is measured on the waved line, and the number of waves is the number of tuning fork vibrations. Hence, by counting the number of waves between each spark hole, the number of vibrations in a given time may be accurately determined. It is found that the effect of a change of temperature of 1° is $\frac{1}{22000}$ of the length of a vibration; and the effect, therefore, of temperature on any fork may be ascertained by multiplying its number of vibrations per second by the decimal 0 00004545. A difference of 10° in temperature, during the use of a tuning fork to measure the velocity of a projectile, would obviously make a serious difference in the record.

General H. L Abbott read a paper on the simultaneous ignition of large numbers of fuses, in mining operations. The essay dealt with mathematical points, and involved many formulæ, but resulted in a rule which has been reduced to practice, so that 2,500 fuses can be fired at a single instant. The speaker said, incidentally, that more than 8,000 fuses would be simultaneously exploded to blow up the Hell Gate excavations.

President F. A. P. Barnard gave a learned exposition of the theory of magic squares, which are arithmetical puzzles, extremely abstruse and of no immediate practical value.

Professor Henry, President of the Academy, in reviewing scientific progress, said that it was contemplated to conduct a series of new experiments, under the auspices of the Smithsonian Institution, to determine accurately the rate of increase of the earth's temperature at progressive depths—also new investigations on the velocity of light. The work of weighing the earth accurately will also, probably, be undertaken anew.

Professor Mayer also read a second paper, showing how certain sounds would extinguish the sensation of other sounds; and adduced the rule that, while low sounds cannot extinguish high ones, the high sounds may obliterate low ones. This fact is of great importance in the conduct of an orchestra. The conductor regulates the players according to the impression, on his ear, of the different sounds at the place where he stands. But what may be perfect there is necessarily imperfect elsewhere; and therefore, at greater distances the high sounds may be killing the lower ones. To provide the best music, the conductor should locate himself in the middle of the room.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for May, 1876.

Mercury.

Mercury rises on May 1 at 5h. 25m. A. M., and sets at 7h. 51m. P. M. On the 31st, Mercury rises at 5h. 47m. A. M., and sets at 8h. 52m. P. M.

Mercury should be looked for after sunset, some degrees north of the point where the sun disappears. On May 21 it will be at its greatest elongation east of the sun, and can easily be found, as it makes very nearly the diurnal path of Venus, and is about 24° nearer the horizon. The new moon is very near Mercury on May 25.

Venus.

On May 1, Venus rises at 7h. 20m. A. M., and sets at 10h. 53m. P. M. On the 31st, Venus rises at 7h. 26m. A. M., and sets at 10h. 35m. P. M.

Venus is at its greatest elongation on May 4. A glass of low power will show that Venus presents phases like the moon. Venus is not at its greatest brilliancy until June, but it can be seen now to cast a shadow when a pencil is held in its light.

Mars.

Mars rises on May 1 at 6h. 38m. A. M., and sets at 9h. 39m. P. M. On the 31st, Mars rises at 6h. 1m. A. M., and sets at 9h. 12m. P. M.

Although Mars is now apparently very small, it is easily found, as it makes nearly the same diurnal path with Venus and shines with a ruddy light. If Mars is seen on the 21st, Mercury can be found nearer the horizon, and nearly in the continuation of the curve which passes through Venus and Mars.

Jupiter.

Jupiter is becoming visible in the evening. It rises on May 1 at 8h. 17m. P. M., and sets at 5h. 55m. the next morning. On May 31, Jupiter rises at 6h. 1m. P. M., and sets at 3h. 46m. A. M. of the next day. Jupiter is still near the star *β Scorpii*, and its daily motions can be watched with reference to this star.

Saturn.

Saturn is seen only in the morning hours. It rises at 2h. 34m. A. M. on the 1st, and on the 31st at 12.40 A. M. It comes to the meridian on the 31st at 6 A. M., and should be looked for in the southeast, before sunrise, at an altitude somewhat less than 31½°.

Uranus.

On May 1, Uranus rises at 11h. 31m. A. M., and sets at 1h. 36m. the next morning. On the 31st Uranus rises at 9h. 36m. A. M., and sets at 11h. 39m. P. M. The position of Uranus is still among the small stars of *Leo*.

Neptune.

Neptune is not only very remote, but at present its path is so nearly that of the sun that it cannot be seen.

Sun Spots.

The report is from March 19 to April 20 inclusive. During this period, photographing has been rendered almost impossible by clouds. In a few cases, very small spots have been seen upon the sun's disk, but at present, with a telescope of 2½ inches aperture, no spot can be found.

The Proposed Aquarium in Central Park.

The subject of an aquarium in Central Park, New York city, is again being agitated, and a bill is before the New State Legislature allowing of the establishment, the same to be under control of the Park Commissioners. We have frequently pointed out the usefulness of such an exhibition, and the benefits which the people would derive from so excellent a means of education and recreation. New York is so situated as to allow of the stocking of a fine aquarium with ocean fishes with but little trouble, and we trust that the appropriation may be granted.

MESSRS. JONES & LAUGHLIN, American Iron Works, Pittsburgh, Pa., employ in one department 62 men, 61 of whom are subscribers to the SCIENTIFIC AMERICAN.

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PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—NUMBER II.

PATTERN MAKING.

Of the different kinds of wood serviceable to the pattern maker, pine is, for many reasons, usually employed. It should be of the best quality, straight-grained, and free from knots; it is then easy to work in any direction, possessing at the same time sufficient strength for all but the most delicate kinds of work, and having besides the quality of cheapness to recommend it. Care taken in its selection at the lumberyard will be amply repaid in the workshop. When it is straight-grained, the marks left by the saw will show an even roughness throughout the whole length of the plank; and the rougher the appearance, the softer the plank. That which is sawn comparatively smooth will be found hard and troublesome to work. If the plank has an uneven appearance, that is to say, if it is rough in some parts and smooth in others, the grain is crooked. Such timber is known to the trade as catfaced. In planing it, the grain tears up, and a nice smooth surface cannot be obtained. Before purchasing timber, it is well to note what convenience the yard possesses for storing. Lumber on the pile, though it be out in all weathers, does not deteriorate, but becomes seasoned; nevertheless its value is much increased if it has an extemporised roof to protect it from the sun and rain: but as it is not convenient to visit the pile for every customer, quantities are usually taken down to await sale, and for such a shelter must be provided, otherwise it will be impossible to insure that the lumber is dry, sound, and fit for pattern making, it being obvious that the foregoing remarks on the storage of lumber apply to all woods.

The superiority of pine for pattern making is not, however, maintained when we come to fine delicate patterns or patterns requiring great durability. When patterns for fine work, from which a great many castings are to be made, are required, a fine pattern wherefrom to cast an iron pattern is improvised, because, if pine were employed, it would not only become rapidly worn out, but would soon warp and become useless. It is true that a pine pattern will straighten more easily than one made of a hard word; but its sphere of usefulness in fine patterns is, for the above reasons, somewhat limited. Iron patterns are very desirable on account of their durability, and because they leave the sand easily and cleanly, and because they not only do not warp but are also less liable than wooden ones to give way to the sand, while the latter is being rammed around them by the molder, a defect that is often experienced with light patterns, especially if they are made of pine. Iron patterns, however, are expensive things to make, and therefore it is that mahogany is extensively employed for fine or durable pattern work. Other words are sometimes employed, because they stand the rough usage of the molding shop better and retain the sharp corners, which, if pine be used, in time become rounded, impairing the appearance of the casting. Mahogany is not liable to warp, nor subject to decay; and it is exceedingly durable, and is for these reasons the most desirable of all woods employed in pattern making, providing that first cost is not a primary consideration. There are various kinds of this beautiful wood, that known as South American mahogany being chiefly used for patterns.

Next to mahogany we may rank cherry, which is a very durable wood, but more liable to twist or warp than is mahogany, and it is a little more harsh to the tool edge. If, however, it is stored in the workshop for a length of time before being used, reliable patterns may be made from it. In addition to these woods, walnut, beech, and teak are sometimes employed in pattern making.

The one property in all timber to be specially guarded against is its tendency to warp, bend, expand, and contract, according to the amount of humidity in the atmosphere. Under ordinary conditions, we shall be right in supposing a moisture to be constantly given off from all the exposed surfaces of timber; therefore planks stored in the shop should be placed in a rack so contrived that they do not touch one another, so that the air may circulate between the planks, and dry all surfaces as nearly alike as possible. If a plank newly planed be laying on the bench on its flat side, the moisture will be given off freely from the upper surface, but will, on the under surface, be confined between the bench and the plank: the result being that a plank, planed straight and left lying as described, will be found, even in an hour, to be curved, from the contraction of the upper surface due to its extra exposure; and therefore it is that lumber newly planed should be stored on end or placed on edge. Lumber expands and contracts with considerable force across the grain; hence if a piece, even of a dry plank, be rigidly held and confined at the edges, it will shrink and rend in twain, often with a loud report. There is no appreciable alteration lengthwise in timber from the above causes; and if two pieces be glued together so that the grain of one crosses that of the other, they can never safely be relied upon to hold. Hence they had better be screwed so that there will be a little liberty for the operation or play of the above forces, while the screws retain their hold. The shrinkage, expansion, and warping of timber may perhaps be better understood by considering as follows: The pores of wood run lengthwise, or with its grain, and hence the moisture contained in these passes off more readily endwise or from any surface on which the pores terminate. Then again the wood shrinks precisely in proportion in which the moisture leaves it; and if we have full knowledge of the direction of the grain, and of the position in which a piece of timber stands or lays, we can (all other things being equal, that is to say, supposing there to be no artificial heat or other disturbing cause operating on one more than on another side of it) predicate in what direction it will warp. Thus, let A,

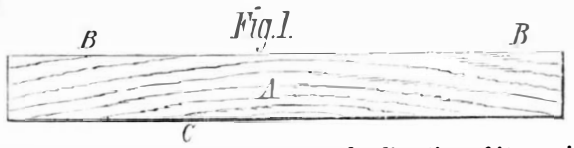


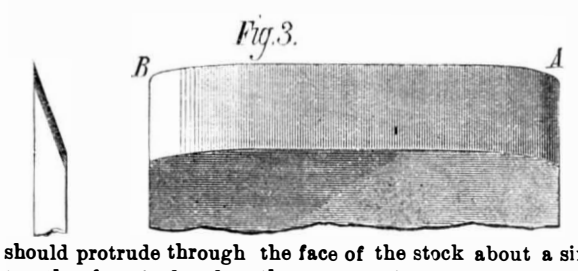
Fig. 1, be a piece of timber having the direction of its grain as denoted by the lines; then its surface, B B, which has the grain and pores terminating upon it, would allow free exit of the moisture, and that face would dry first (especially if it lay uppermost) and would contract the most, so that after a time the shape of the piece would be curved, as shown in Fig. 2. Now if it had been placed to lay with the face, C,

uppermost, the warping would have been much less, because the extra porosity of the face, B B, would have been counteracted by the lack of circulation of air. If, on the other hand, it was placed endwise, the warping, though it would have taken place, would have been appreciably less. It must not be supposed that thoroughly seasoning the timber will remove the tendency to warp, for timber, however long and carefully it has been dried or seasoned, undergoes considerable transformation of shape so soon as much of its outer surface is removed, making it appear that the seasoning or drying process takes place mainly at and near the outer surfaces, and is renewed every time an entirely new surface is presented to the action of the atmosphere. Thus, if we take a thoroughly seasoned piece of wood 3 inches square and 1 foot long, and cut it into strips 1 inch square and 1 foot long, the pieces will warp in a day or so; and if, after a few days, we take those inch strips and cut them into strips ¼ inch square and 1 foot long, these latter will again warp; and no matter what pains might be taken with these last strips to season them and let them assume their new shape, were we to cut them into thin veneers the warping process would again set in. It is well, therefore, in particular work, to cut out roughly the various parts of the pattern, so that, while some parts are being operated upon, the others may be assuming their new shape, and thus become not so liable to warp after being worked up in the pattern.

TOOLS, ETC

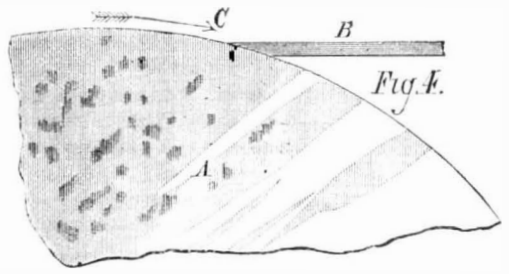
One of our first requisites in the way of tools and appliances will be a carpenter's bench, which may be made as follows: Three pieces of stuff, 2x5 inches and 3 feet long, will serve for supports for the top. Two 12 inch boards, 12 feet long and 1 inch thick, will do for the sides. Nail these side boards firmly to the 2x5 inch cross pieces, and put on a top of suitable material, and the bench is ready for the legs. Now take four pieces of stuff, 2x5 inches, and of the requisite hight for the legs, and frame a piece 1x3 inches across each pair of legs, about 6 inches from the bottom, placing the legs at the distance apart necessary for the width of the bench. Then cut a fork or slit in the top end of each leg, so as to straddle the cross piece at the ends, and put a bolt $3\frac{1}{2}x\frac{5}{8}$ inches through each leg and through the side boards, and the bench will be complete; and it will possess the advantage that it can be taken down in a few minutes by removing the bolts from the legs.

The jack plane is employed for roughing off the surface timber; the stock is made of beech and the blade of cast steel. The blade acts most effectively when it is ground well away toward the corners, thus producing a curved edge, as shown in Fig. 3. When the blade is placed in the stock, and in position to cut off the largest amount of stuff, its

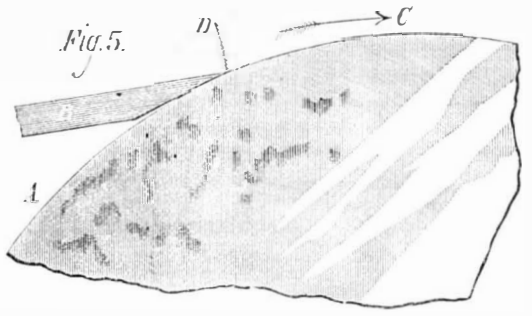


should protrude through the face of the stock about a sixteenth of an inch, while the corners, A B, are about level with the face of the stock. The beveled face should stand at about an angle of 50° to the flat face. In grinding it, care should be taken to grind it as level as possible, rounding off the corners as shown above. The grindstone should be kept true and liberally supplied with water; the straight face should not be ground away, nor indeed touched upon the stone, except to remove the burr which will sometimes turn over. The pressure with which the blade is held against the grindstone should be slight at and toward the finishing part of the grinding process, so as not to leave a long ragged burr on the end of the blade, as is sure to be the case if much pressure is applied, and it will occur to a slight extent even with the greatest of care. The blade should not be held still upon the grindstone, no matter how true, flat, or smooth the latter may be; but it should be moved back and forth across the width of the stone, which will not only grind the blade bevel even and level, but will also tend to keep the grindstone in good order.

If a grindstone is in excellent condition (that is, true, flat, and level, or slightly rounding), as it should be, it tempts the workman to grind the plane blade with the stone running toward him, as shown in Fig. 4, for the following reasons: If the stone, A, travels in the direction of the arrow, C, the plane blade, B, will relieve the abrasion of the stone



at the cutting edge first, thus leaving it clean and with no tendency to leave a long ragged edge; but if the blade were held on the other side of the stone, that is to say, with the stone running from the operator, as shown in Fig. 5, the result will be a long ragged edge on the plane blade, especially if much pressure be placed on the blade.



In Fig. 5, A represents the grindstone, B the plane blade and C the direction in which the grindstone is supposed to revolve: in which case it becomes evident that the plane blade will receive at its edge some pressure in the direction of the arrow, D; and the metal at the cutting edge of the blade, being very thin, gives way to this pressure and bends back instead of abrading off, leaving a long feather edge, as shown in Fig. 6, from A to B. This edge breaks off in many cases further back than it should do, and inevitably breaks off when the blade is applied to the oilstone, leaving upon the face of the oilstone particles of steel which must be removed before a good edge can be secured to the tool. As a rule, however, this feather edge is broken off by tapping the blade on the palm of the hand, or it may be removed by passing the edge lengthways on a piece of wood. It is,

however, better to hold the blade as shown in Fig. 3, but there are other considerations which sometimes render this impracticable. For instance, if the stone is not quite true, the high spots will strike against the cutting edge, and render it impossible to hold the blade steadily, and hence impossible to grind it true. If the stone has soft spots in it, as most stones have, the blade will dig in those soft spots, and will also be thrown off the stone when encountering an unusually hard spot. If, in consequence of digging in a soft spot, the blade catches, the cutting edge will be ground completely off; so that it is only under exceptional and unusual circumstances that the blade can be ground in the position shown in Fig. 3. It is better, therefore, to grind it in the position shown in Fig. 4, which is safer and surer. In oilstoning a plane blade, the straight face should be held quite level with the face of the oilstone, so that the cutting edge may not be beveled off. Not much application to the oilstone is necessary to the straight face, because that face is not ground upon the grindstone, and it only requires to have the wire edge or burr removed, leaving an oilstone polish all along the cutting edge. The oilstoning should be performed alternately on the flat and beveled faces, the blade being pressed very lightly on the oilstone toward the last part of the operation, so as to leave as fine a wire edge as possible. The wire is the edge or burr which bends or turns over at the extreme edge of the tool, in consequence of that extreme edge giving way to the pressure of the abrading tool, be it a grindstone or an oilstone. This wire edge is reduced to a minimum by the oilstone, and is then so fine that it is practically of but little account; to remove it, however, the plane blade or iron may be buffed backwards and forwards on the palm of the hand.

The iron being sharpened, we may screw the cover on, adjusting it so that its edge stands a shade below the corners of the iron, and then screwing it tight; the blade or iron and the cover must now be placed in the mouth of the plane stock, and adjusted in the following manner: The plane iron should be passed through the mouth of the stock until as much in depth of it is seen to protrude from the bottom face of the stock as is equal to the thickness of shaving it is intended to cut: to estimate which, place the back end of the plane upon the bench, holding the stock in the left hand with the thumb in the plane mouth, so as to retain the iron and wedge in position. the wedge being turned toward the workman. A glance down the face of the stock will be sufficient to inform the operator how much or how little the cutting edge of the iron protrudes from the face of the plane stock, and hence how thick his shaving will be. When the distance is adjusted as nearly as possible, the wedge may be tightened by a few light blows of the hammer. If, after tightening the wedge, the blade is found to protrude too much, a light blow on the fore end of the top face of the plane will cause it to retire; while a similar blow upon the back end will cause it to advance. In either case the wedge should be tightened by a light blow after it is finally adjusted.

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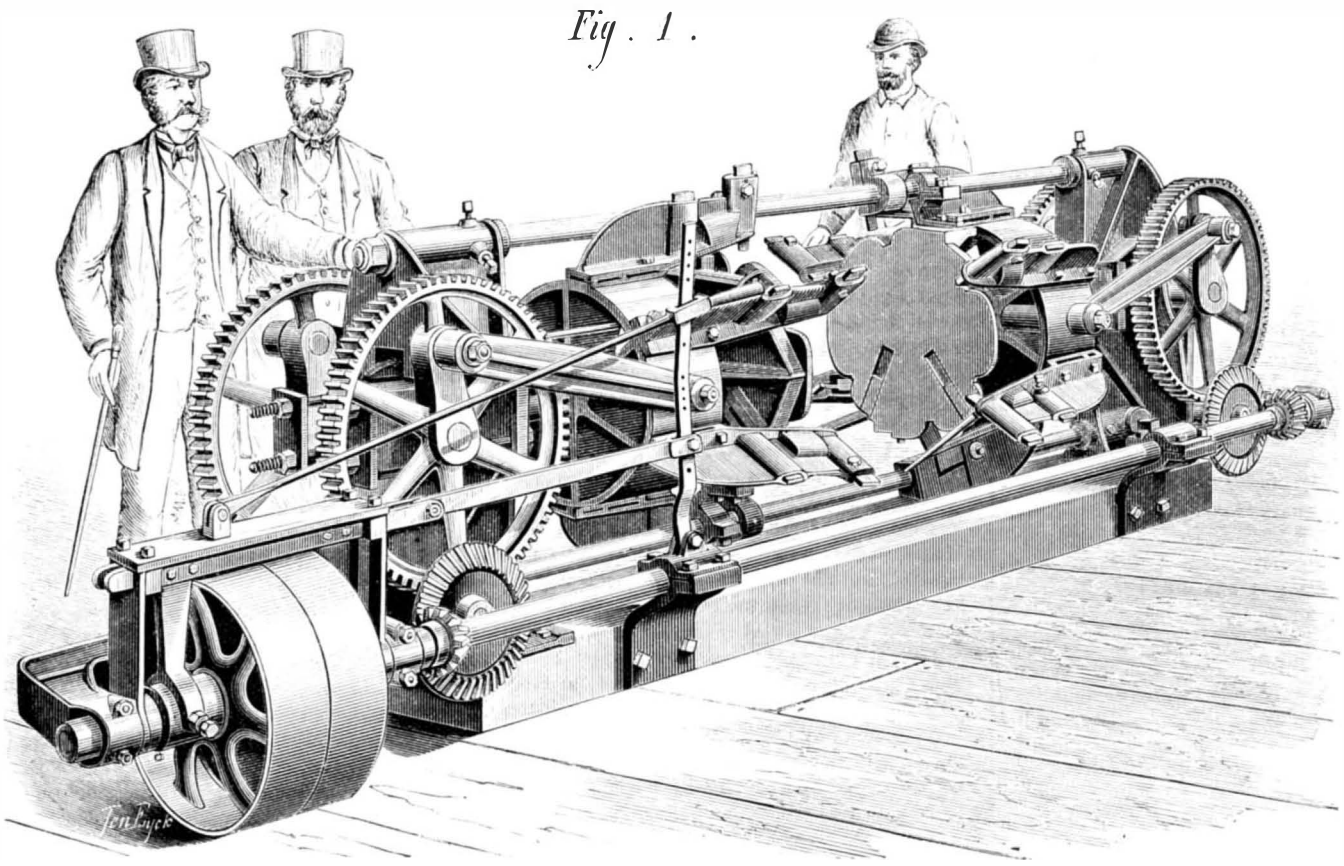
IMPROVED KEG AND BARREL MACHINERY.

In our issues of March 8, 1874, and February 6, 1875, we published several illustrations, together with detailed descriptions, of new coopering machinery, patented and manufactured by Messrs. E. & B. Holmes, of 59 Chicago street, Buffalo, N.Y. The devices then referred to, which, as we stated, worked a practical revolution in the cooper's trade, related mainly to the manufacture of barrels by machinery, said mechanism in many instances being the first ever invented for performing operations hitherto done by hand labor. To this valuable category of apparatus, the manufacturers have now added a new series of machines designed for the production of kegs and small casks of all kinds and sizes less than barrels, besides a number of novel devices devoted, as before, to improved barrel manufacture.

In Fig. 1 is represented an entirely new machine for leveling and then trussing slack barrels. It is constructed with an iron frame upon which are placed two leveling plates upon slides or guides, which plates are operated by cams. There are also two other plates placed upon slides, and operated at each end by cranks. Upon these plates are hoop drivers, for driving all the truss hoops upon a barrel at one and the same time. The leveling plates are first moved toward each other and against the ends of the barrel by cams. The barrel is thus leveled and held in position while the hoop drivers force all the truss hoops to their places. The leveling plates and drivers then recede, and one barrel is discharged from the machine by the introduction of another. The apparatus is so rapid in its operation that, by the help of one man, from 4,000 to 5,000 barrels can be trussed per day.

Fig. 1.



MACHINE FOR LEVELING AND TRUSSING SLACK BARRELS.

Fig. 2 is a machine for chamfering, howeling, and crozing kegs and small casks. It is adapted for finishing the ends of kegs or small casks of all sizes, from small kegs to half barrels, ready to receive the heads. It finishes both ends of the keg at the same time with great accuracy. The keg is placed on the machine and forced into chuck rings, which are caused to revolve by teeth, upon their outer edge, engaging with pinions upon a common rotating shaft. Rotary cutters are brought in contact with the ends of the keg, which are finished by a single revolution. The machine is easily altered from one size to another by changing the chuck rings. Its capacity is from 2 000 to 3,000 kegs per day.

In Fig. 3 (see next page) is represented a machine for rounding heads of all sizes for kegs and barrels. This is so constructed that every size of heads for kegs, small casks, and barrels can be made upon it for both tight and slack work, and the change from one size to another is easily and quickly accomplished. The saw and cutters are brought in contact and passed through the wood on such lines as to prevent the tearing, splitting, and slivering of the material used, and to give a smooth finish to the work done. No more set is required in the saw than is necessary in a common circular saw. The machine is made with a strong iron frame, on which is placed a clamp for holding the head. There are, besides, a swing frame, carrying a concave saw and cutters for rounding and chamfering the head, and an automatic apparatus for discharging it when finished.

In operating the machine, the blank is placed between the clamps, and at the same time the foot treadle is pressed. This clamps the blanks, and also brings the concave saw and cutters in contact with it, and holds them there until the head is finished, when the latter is released through the automatic action..

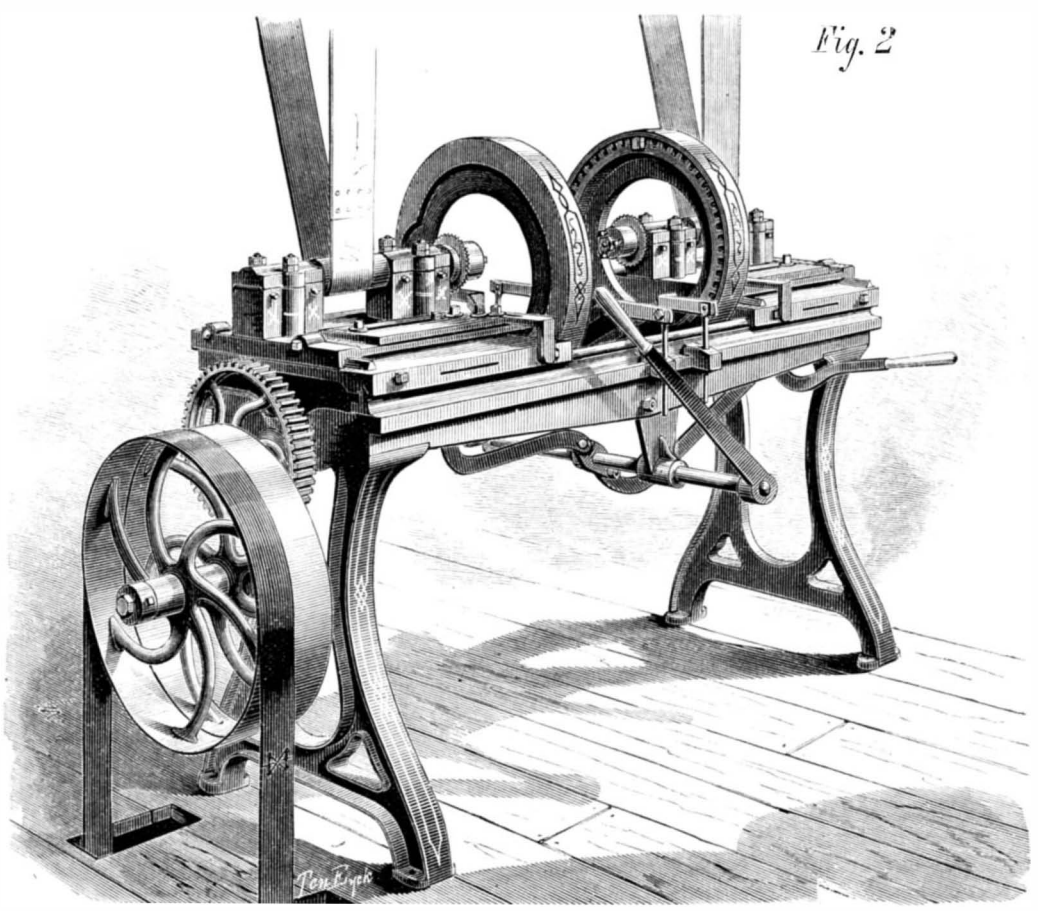
In the following engraving, Fig. 4, is exhibited a power windlass for kegs and slack barrels. This is for drawing up or together the ends of staves of a keg or barrel, ready to receive the head truss hoop, after they have been set up in the setting-up form with their other ends in the other head truss hoop. The machine is constructed with a frame upon which is planted a windlass supplied with a rope, which windlass is operated by friction wheels.

After the barrel or keg has been set up with the ends of the staves in one head truss hoop, it is placed in the machine, and the rope is placed around the flaring ends of the staves. The friction wheels are then brought in contact with each other, when the windlass is set in motion, drawing up the staves, by the aid of the rope, ready to receive the other end or head truss hoop. This apparatus is very rapid in its operation, and will windlass from 2,000 to 2,500 kegs or barrels per day.

Fig. 5 is a machine for leveling and trussing kegs and small casks, from the smallest kegs to half barrels, and can be easily and quickly adjusted. The truss hoop drivers are attached to two plates, one of which is stationary and adjustable, and the other is moved to and from it perpendicularly by cranks and pitmans. The drivers move automatically in and out, to allow the reception and discharge of the keg into and from the machine. The plates level and the drivers drive the truss hoops at one and the same operation upon the keg, by the movable plate being brought in contact with the upper end of the keg by the action of the cranks and pitmans, the two cranks being on the same shaft. The machine works rapidly, and will level and drive the truss hoops upon from 4,000 to 5,000 kegs per day.

This subject will be resumed in our next issue

Fig. 2



BARREL CHAMFERING, HOWELING, AND CROZING MACHINE.

Iron Freight Cars.

The La Mothe Manufacturing Company, of Providence, R. I., is building iron freight platform cars which are thus described: Six sills, 30 feet in length, each being composed of three 2-inch boiler tubes, are placed one above the other. These are three inches apart, but are secured to each other by bands or tie blocks of the best charcoal iron, forming a single sill, which is, from its nature, of great strength. These sills are placed under the car 20 inches apart, and are connected and held in place by forty-five ⅞ inch soft steel rods, running through the tie blocks and riveted at each end, by which means the entire structure is rendered perfectly compact, and becomes a unit. Transom beams are placed at each end at the proper point, to connect with the trucks. These consist of four boiler tubes of like size with the sills, and are securely fastened to each other. Large rods are employed to strengthen the center of the car, and are fixed to the sides by improved and patent couplings. This arrangement is actually stronger than the sills themselves. The usual truss rods are also used, the best ⅞ inch steel for the purpose being employed. The only wood used is the planking of the platform, which is secured to the sills by means of staples. The entire mechanism is void of welding, nuts, joints, or mortises. The actual weight of the car without the trucks is not over 40 per cent of that of the ordinary car. The carrying capacity of this car is set at 20 tuns. The ordinary platform car weighs about 6 tuns, and is considered heavily loaded with 12 tuns, a fair burden being from 8 to 10. The ordinary car, capable of carrying but 10 tuns, must carry a dead weight of 6 tuns; while this new invention will, it is claimed, with absolute safety carry 20 tuns, with a dead weight of but 3 tuns. The same principle is to be applied in building box cars. Greater safety in case of collision or fire is claimed for these cars. A platform car of this kind has been in use on the Providence and Worcester Railroad since September for transporting stone. Its weight is 3,560 lbs. less than their ordinary platform cars, and in strength and durability it gives great satisfaction.

Condensed Eggs.

It is astonishing, says the British *Trade Journal*, what progress has been made during the past few years in the art of preserving aliments generally, and that a great boon has thereby been conferred all round we have daily evidence. The superfluous herds of Australasia and South America are now potted, or, we should perhaps say, "tinned," for the English and other markets, thus affording comparatively cheap animal food for the less opulent classes. America sends us in large quantities the products of her waters, which but for preservative processes would be lost to the old world; Switzerland is fast ruining the milkman's business in this country; from across the Channel come supplies of vegetables in a form qualified to journey round the world without deterioration; and Denmark exports her delicious butter in ever-increasing quantities, well protected from the effects of keeping and climatic change. In fact, preserved provisions now include a vast variety of substances hailing from all parts of the world. Although more the recipients than the producers of such goods, there are many articles of the kind which we are able to send abroad, and the productions of the Scotch provision factories are especially esteemed in certain parts. Only recently a new product has been brought into notice which bids fair to gladden the hearts of our colonists who swear by the virtues of British beer. We see no reason why condensed beer should not be as good in its way, and prove as great a success, as condensed milk. But we have strayed somewhat from our immediate object, which is to call attention to condensed egg, a sample tin of

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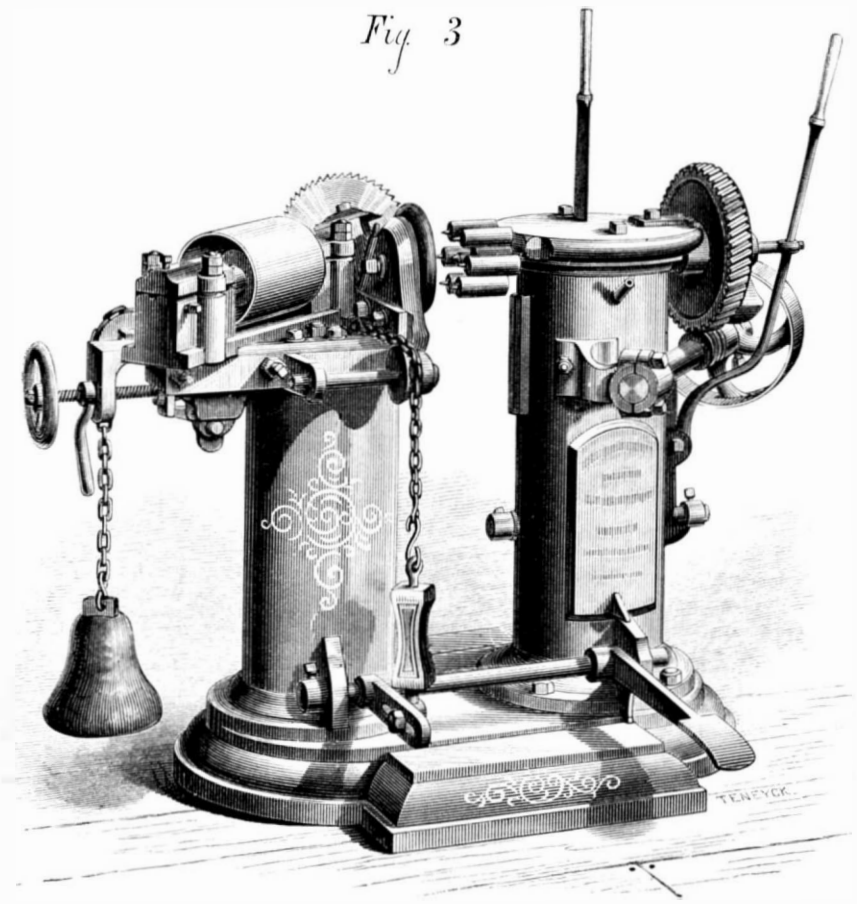
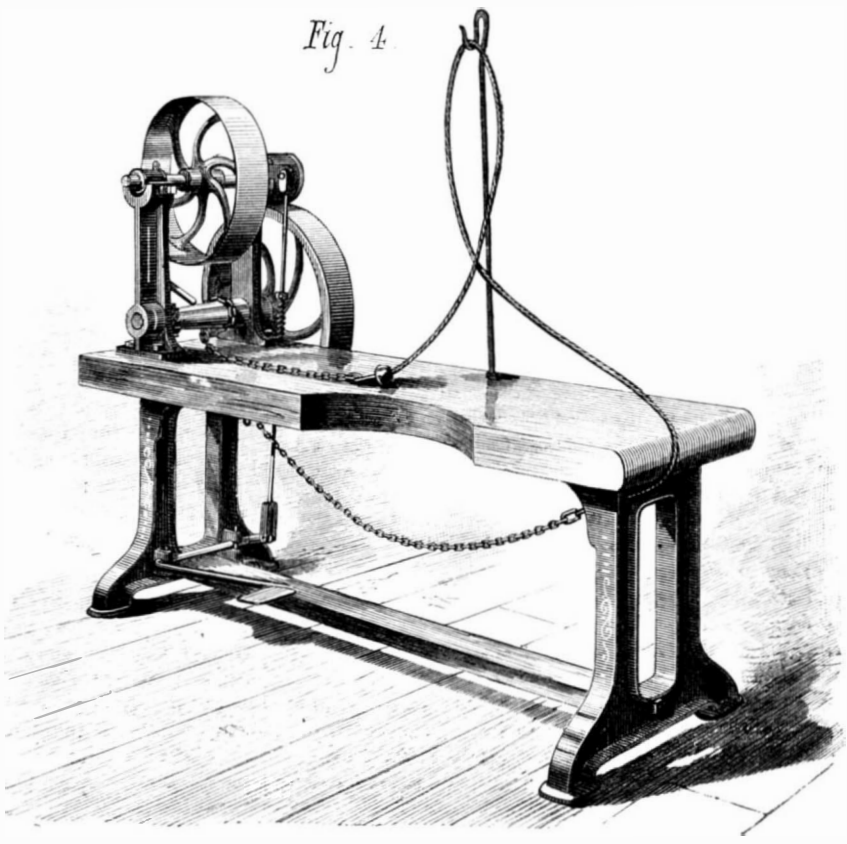
of which, prepared in Bavaria, has reached us. This article is prepared from fresh raw eggs by a process of desiccation, which, while effectual in removing all traces of moisture, leaves the natural properties of the egg unimpaired. It is only necessary to add a due proportion of water to the egg powder to render it fit for culinary purposes, the active constituents of one egg being contained in about a teaspoonful of the powder. That this is a valuable addition to the line of concentrated natural aliments will be admitted, we think, by those who, getting the better of a perhaps not altogether inexcusable prejudice, venture on a trial. The contents of a small sized tin are about equal to twelve eggs.

Fig. 3



MACHINE FOR ROUNDING BARREL HEADS.

Fig. 4



WINDLASS FOR DRAWING BARREL STAVES TOGETHER.

Action of Different Solutions on Metals.

Professor A. Wagner, of Munich, has recently made a series of careful experiments to determine the action of different solutions on copper, zinc, lead, tin, Britannia metal, brass, and German silver, first in air free from carbonic acid, then in the presence of carbonic acid and air. These metals and alloys were in the form of foil, of equal surface, namely two square inches, and of as nearly equal thickness as possible. The copper foil was as good as chemically pure; the zinc was common sheet zinc with 0·68 per cent of lead; the lead was cut from commercial sheet lead; the tin was the pure cast metal. The Britannia metal was a piece of new sheet metal intended for the drums of gas meters, and consisted of 90 per cent tin and 10 per cent antimony. The brass was composed of 64½ per cent copper and 35½ per cent zinc. The German silver was 70 2 per cent copper, and 29·8 zinc and nickel. These pieces of sheet metal were placed vertically in glass vessels, each holding 6 1 cubic inches of the solution to be tested, the metal being completely covered with the solution. In the experiments they were left in the solution for a week. The results of these experiments, as given in the Bavarian *Industrie und Gewerbeblatt*, were as follows

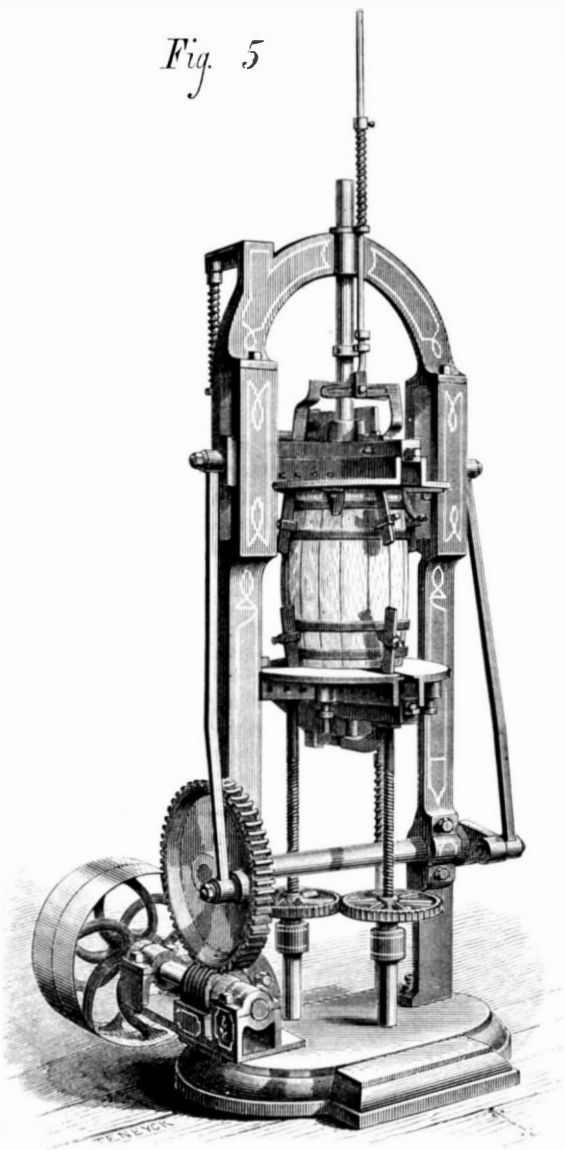
In freshly boiled distilled water, zinc suffered the most change of all the metals tested; tin and Britannia metal suffered no change. With access of air and carbonic acid, the action upon lead, copper, zinc, brass, and German silver was much more energetic than in the presence of air free from carbonic acid. In the latter case only traces of copper, zinc. and lead were dissolved; tin, Britannia metal, brass, and German silver were not attacked at all. In the presence of carbonic acid and air, tin and Britannia metal were the only metals not attacked; all the other metals were perceptibly dissolved.

In chloride of sodium and chloride of potassium solutions, with access of air and carbonic acid, copper, brass, German silver, and zinc were violently attacked, while in the absence of carbonic acid they underwent comparatively little change. The contrary was the case with lead, tin, and Britannia ware, they being attacked more violently when exposed to air free from carbonic acid than in air and carbonic acid. In the latter case, lead was only half as much affected as in former, tin not at all, and Britannia metal very little. With access of air free from carbonic acid, not a trace of any of the metals was dissolved; with access of air and carbonic acid, considerable quantities of copper, brass, German silver, zinc, and lead were converted into soluble compounds, only a trace of Britannia metal went into solution, and no tin was dissolved.

In sal ammoniac solutions, with access of air free from carbonic acid, copper was attacked prodigiously, also brass, German silver, and zinc; Britannia metal, tin, and lead comparatively little. In the presence of both air and carbonic acid, strangely enough, all the metals, with the single exception of German silver, were less attacked than when the carbonic acid was absent; namely, copper only about one sixth; lead, only about one half as much; tin and Britannia metal not at all. With access of air, with or without carbonic acid, a considerable quantity of each metal went into solution, with the exception of tin and Britannia metal, of which, in both cases, not a trace was dissolved.

The action of copper, and in a less degree of brass and German silver, towards sal ammoniac solution is worthy of attention. Within a week, a large quantity of copper was dissolved, the liquid became dark blue, and contained a perceptible quantity of ammonia. By allowing the sal ammoniac to act upon the copper for a long time, at ordinary temperature, a compound of ammonio-cuprous chloride with ammonio-cupric chloride was formed. The action of sal ammoniac solutions on copper seemed, however, to be essentially dependent upon the unrestricted access of the atmospheric oxygen. The loss of weight of one square inch of copper foil, in the experiment, in which air free from carbonic acid was passed through the solution, was 13·56 grains in a week; while one square inch of copper foil, standing vertically in a solution containing 15 grains sal ammoniac to 8·1 cubic inches of water, in an open glass covered with paper, lost only 3·68 grains. If copper is boiled in a solution of sal ammoniac, with or without access of air, ammonia is continually liberated, even for hours.

Fig. 5



MACHINE FOR LEVELING AND TRUSSING KEGS.

In water containing chloride of magnesium, in the presence of air free from carbonic acid, lead and zinc were most strongly attacked, tin and Britannia were only very slightly. The action upon lead and copper is about the same as that of the alkaline chlorides; zinc, brass, and German silver are more strongly affected. In the presence of carbonic acid and air, chloride of magnesium has about the same effect upon copper and German silver as the alkaline chlorides, and a much stronger one on lead, zinc, and brass. In this case, tin is perfectly protected from corrosion. When carbonic acid is absent, perceptible quantities of zinc alone go into solution, as well from sheet zinc as from brass and German silver. In the presence of air and carbonic acid, considerable quantities of all the metals are dissolved, except tin, of which none is dissolved, and Britannia metal, of which traces only are dissolved.

In solutions of sulphate of potassa, copper, lead, brass, and German silver were perfectly protected from loss of weight in the presence of air free from carbonic acid, the loss of weight of zinc was considerable, of tin and Britannia metal inconsiderable. With access of air and carbonic acid, lead, tin, and Britannia ware suffered no loss of weight; copper, brass, and German silver lost equally and slightly in weight, zinc considerably. None of the metals were dissolved in the absence of carbonic acid; but in its presence, copper, zinc, brass, and German silver were dissolved in perceptible quantities; lead, tin, and Britannia metal were not dissolved.

In water containing saltpeter and air free from carbonic acid, lead and zinc were attacked most violently; tin and Britannia ware a little; copper, brass, and German silver not at all. With air and carbonic acid present, zinc and lead were attacked most; copper, German silver, and brass were not more acted upon than by distilled water; tin and Britannia metal were acted upon somewhat. None of the metals were dissolved when carbonic acid was absent; when it was present, perceptible quantities were dissolved.

In carbonate of soda, and air free from carbonic acid, lead, copper, brass, and German silver lost nothing in weight; but zinc, tin, and Britannia metal were sensibly affected. Perceptible quantities of tin and Britannia ware were dissolved; none of the other metals went into solution. It was not possible to pass carbonic acid into the solution, as this would convert the carbonate of soda into bicarbonate of soda.

In water containing caustic soda, and air free from carbonic acid, lead, tin, Britannia metal, and zinc suffered a very considerable loss; brass and German silver an inconsiderable loss; copper, none. A good deal of lead, tin, Britannia metal, and zinc were dissolved; only a little brass and German silver, and no copper. It was impossible to pass carbonic acid and air into the solution, because it would convert the caustic soda into carbonate of soda.

In lime water, with air free from carbonic acid passed into it, lead lost considerably in weight; zinc and brass an inconsiderable quantity: copper, tin, Britannia metal, and German silver, none at all. A perceptible quantity of lead was dissolved, but only traces of zinc and brass. It was, as before, impossible to perform the experiment in the presence of carbonic acid, as this would form carbonate of lime.

Reviewing these results, and classifying them according to the metal, we find that they are affected as follows:

Copper, in the presence of air free from carbonic acid, is very energetically attacked by a solution of sal ammoniac

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(loss of weight, 13 56 grains) only slightly by chloride of magnesium (0·075 grain), and alkaline chlorides (0·06 grain), extremely little by distilled water (0·015 grain), not at all by sulphate of potassa, saltpeter, carbonate of soda, caustic soda, or lime water. Quite a considerable amount of copper was dissolved by sal ammoniac, only traces of it by distilled water; none of the other solutions were able to convert any copper into soluble compounds. In the presence of carbonic acid, the copper was attacked by all the solutions, most violently again by sal ammoniac (loss, 2·14 grains), the action being only about one sixth of that without carbonic acid. The alkaline chlorides dissolved 1·76 grains, chloride of magnesium, 1·72 grains, being nearly as strong as sal ammoniac. Sulphate of potassa acted feebly (0·060 grain). and so did saltpeter (0 045 grain) in distilled water (0·045 grain). All these solutions dissolved perceptible quantities of copper.

Zinc, in the absence of carbonic acid, was attacked by every solution, most violently by caustic soda (loss 0·90 grain) and sal ammoniac (0 76 grain), considerably by sulphate of potassa (0 045 grain), less by chloride of magnesium, distilled water, and carbonate of soda (0·195 grain), quite feebly by saltpeter (0 135 grain) and alkaline chlorides (0·105 grain), inconsiderably by lime water (0 045 grain). Perceptible quantities of soluble zinc compounds are produced by the action of caustic soda, sal ammoniac, and chloride of magnesium; traces only by distilled water and lime water. None of the other solutions produced soluble zinc compounds. In the presence of air and carbonic acid, all solutions act upon zinc; chloride of magnesium acts the strongest (loss 0·810 grain); next to it, sulphate of potassa (0 795 grain). The alkaline chlorides act considerably (loss 0·57 grain), and almost equally with saltpeter (0 555 grain) and sal ammoniac (0·54 grain); distilled water less (0·285 grain). Perceptible quantities of zinc were dissolved by each solution.

Lead, in air free from carbonic acid, was very strongly attacked by caustic soda (loss, 6 45 grains); considerably by lime water (2·055 grains); less by alkaline chlorides (0·315 grain); chloride of magnesium (0·3 grain); saltpeter (0 21 grain), and sal ammoniac (0·18 grain); still less by distilled water (0·045 grain); and not at all by sulphate of potassa and carbonate of soda. Caustic soda, lime water, and sal ammoniac converted perceptible quantities of lead into soluble compounds, chloride of magnesium and distilled water only traces of it; while sulphate of potassa, carbonate of soda, saltpeter, and alkaline chlorides dissolved no lead. With access of carbonic acid and air, the chloride of magnesium acted most strongly (loss, 0·525 grain); next saltpeter (0 31 grain) and alkaline chlorides (0·18 grain); still less distilled water (0·12 grain) and sal ammoniac (0·075 grain) Sulphate of potassa was again powerless to affect the lead, and did not dissolve a trace of it, while all the other solutions dissolved perceptible quantities of it.

Tin, in the absence of carbonic acid, was energetically attacked only by carbonic soda (loss, 0·33 grain). Of the other solutions, it lost, in carbonate of soda, 0 105 grain; in alkaline chlorides, 0 90 grain; in sal ammoniac, 0·075 grain; in saltpeter, 0 045 grain; in sulphate of potassa, 0 03 grain; and in chloride of magnesium, 0·015 grain: while it was unaffected by distilled water and lime water. Only caustic soda and carbonate of soda were able to dissolve perceptible quantities of tin. Carbonic acid and air hinder, in a remarkable manner, the action of these solutions upon tin, with the single exception of saltpeter, which acts very faintly (loss, 0·015 grain).

Britannia metal acts quite analogous to tin. In air free from carbonic acid, caustic soda acts most violently (loss of weight, 1·41 grains); the others act inconsiderably. The loss of weight in alkaline chlorides was only 0·135 grain; in carbonate of soda, 0·09 grain; in sal ammoniac, 0·045 grain; in sulphate of potash, chloride of magnesium, and saltpeter, each only 0·015 grain; and in distilled water and lime water, it was unacted upon. Caustic soda and carbonate of soda alone dissolved perceptible quantities of the metal. In the presence of carbonic acid and air, as in the case of tin, distilled water, sal ammoniac, and sulphate of potassa do not act at all; the alkaline chlorides, chloride of magnesium, and saltpeter act very feebly (loss, 0·015 grain); and saltpeter alone dissolves enough metal to be detected.

Brass acts, on the whole, in a manner analogous to copper. With access of air free from carbonic acid, it is strongly attacked by sal ammoniac (loss of weight, 4·035 grains), only slightly by chloride of magnesium (loss, 0·6 grain), alkaline chlorides, caustic soda, and lime water (each 0·03 grain), and not at all by distilled water, sulphate of potassa, saltpeter, and carbonate of soda. Perceptible quantities of metal are dissolved by sal ammoniac and chloride of magnesium, and traces of it by caustic soda and lime water. In the presence of carbonic acid and air, it is acted on most violently by sal ammoniac (loss, 2·505 grains) very strongly; by chloride of magnesium (loss, 1·38 grains), and alkaline chlorides (loss, 1·2 grains); less by distilled water and carbonate of potassa (each 0·06 grain), and saltpeter (loss, 0·045 grain). All the solutions dissolved perceptible quantities of the metal.

German silver acts like brass, but on the average is less energetically attacked. In air free from carbonic acid, it is less strongly attacked than brass, although quite strongly by sal ammoniac (loss of weight, 0·129 grain), less by chloride of magnesium (loss, 0·045 grain), alkaline chlorides (0·015 grain), and caustic soda (0·15 grain), not at all by distilled water, sulphate of potassa, saltpeter, carbonate of soda, and lime water. Perceptible quantities of metal were dissolved by sal ammoniac and chloride of magnesium; traces only by caustic soda. In carbonic acid and air, the sal ammoniac acts the strongest (loss, 1·74 grains), next to this are chloride of magnesium (1 005 grains), and alkaline chlorides (0·915 grain), still less distilled water, sulphate of potassa, and saltpeter (each 0 015 grain). Perceptible quantities of metal are dissolved by all these solutions.

Copyrights.

Mr. Rowland Cox, says: In the case of Lawrence *vs.* Cupples, Judge Shepley has announced it as his opinion that, in an action for the infringement of a copyright, where the resemblances are accidental or arise from the nature of the subject treated in the two books, there can be no recovery. To constitute an infringement of a copyright, the learned judge says, there must be piracy; the defendant must have used the plaintiff's book as his model. Although the defendant's work cover the same ground as the plaintiff's, and answers the same purpose *in toto*, it will be no infringement if it is not an appropriation of plaintiff's particular method Hence, where the plaintiff had compiled a book bearing the title "The Advertiser and Collector's Chart," containing certain lists and names, and defendant issued a book entitled "The New England Mercantile Guide," which contained the same lists, it was held that there was no infringement.

There can be no doubt that a copyright which purports inferentially to cover anything akin to a subject is of no avail. It is idle to attempt to make a copyright effect, directly or indirectly, the functions of a patent or a trademark. The three are possibly of the same genus, but, as species, are widely separated; and to confound them inevitably leads to illogical conclusions.

The Comacho Electric Machine.

The Comacho magnetic machine, with its concentric iron tubular magnets, may be seen at 171 Queen Victoria street. There can be no doubt of the advantage of this form of magnet; but experiment on the resistance of the circuit, weight lifted, electro-motive force, and consumption of zinc, etc., would form an interesting subject. The machine, with five cells of a bichromate battery, works three or four sewing machines. Attempts to work it with the thermopile have hitherto failed. This is very likely, because the elements of the thermopile are coupled up in considerable series, so that, considering the resistance of each element, the whole resistance must be great compared with the resistance of the wire round the magnets. A thermopile should be made of low resistance by coupling a number of elements together in parallel circuit, and then taking some ten or twelve, or more, of such series coupled in succession. It is no doubt worth considerable experiment to attain a successful result from the thermopile, as in that case, by merely turning on the gas, a lathe or sewing machine be made to work.—*Telegraphic Journal.*

Rotary Engines.

According to the invention of Mr. Urbain Chauveau, of Paris, a cylinder is arranged with a piston which may be actuated by steam, compressed air, or gas, so as to move round an axis passing through a center. If a point of the piston rod is forced to move in the space of a fixed circle having for its center a given point, so that the distance is equal to one half of the stroke of the piston, it will be readily understood that the alternate motion of the piston in the cylinder will produce a continuous rotary motion of the said cylinder round the axis. Different arrangements of mechanical parts may be employed to carry out the principle abovementioned, and the construction of rotary engines of this character may be varied to a great extent, and yet in accordance with the same principle. The admission of steam may be made in any ordinary manner.

Drilling and Boring.

An invention by Mr. J. Dodge, of Manchester, England, consists in an improved compound machine, by which four or other convenient number of holes can be drilled or bored at the same time, and by which the spindles of the drilling or boring tools at opposite sides of the machine are set simultaneously, and in unison with each other. His improved machinery consists of a foundation plate, and of four standards, which are connected by cross slides supporting the boring headstocks; the cross slides are raised or lowered, and the boring headstocks are traversed to and fro on the cross slides by screws, all of which are connected together.

Large Lap-Welded Tubes.

The National Tube Works Company have just completed, at their works at McKeesport, Pa., a sample pipe for exhibition at the Centennial. It is 14 feet in length and of 14 inches outside diameter and 10 inches inside, the iron of which it is made being 2 inches in thickness. This is said to be the heaviest piece of lap-welded pipe ever made in this or any other country, and it is stated that such heavy work has never been attempted by any other establishment.

The Hell Gate Obstructions.

The drilling of the chief obstruction at Hell Gate is finished, and the machines have been transferred to Flood Rock. The *débris* have been cleared away from the shaft, and the caves formed by the deep headings are now in a good condition to be explored. Experiments are being made daily in explosive material, to ascertain the safest. The mine will be sprung next July or August. There are 172 pillars which support the rocky roof; 8,000 borings have been made for inserting explosive matter. Those in charge of the work apprehend more danger from the surging of the water than from the shock at the time the rock is shattered. The work at Flood Rock is carried on day and night.

A New Electric Battery.

M. Cerpaux proposes a battery made of a certain number of plates of copper and of zinc separated by a wooden lath. The plates are plunged in sand or moist earth, and an electric current is at once produced. If on the earth chloride of sodium be poured, a very intense current is generated.

Steam Street Cars in Philadelphia.

Steam street cars are now in operation on one of the railroad lines in Philadelphia. The local papers state that the objection that horses will be frightened by the exhaust has not been realized, as no runaways have occurred, nor do the animals seem at all alarmed by the proximity of the machines.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

PATENT SHADE FIXTURES.—STEWART HARTSHORN *vs.* JOHN SHOREY *et al.*

[In equity.—Before SHEPLEY, J.—Decided October term, 1875; to wit, February 17, 1876.]

SHEPLEY, J.:

This bill is for an alleged infringement of letters patent No. 2,756, dated August 27, 1867, granted to Stewart Hartshorn for improvement in spring fixtures for shades. These are the same letters patent which were the subject matter of litigation in Hartshorn *vs.* Almy, and Hartshorn *vs.* Tripp *et al.*

Defendants rely upon two grounds of defense:

First, that the alleged invention of Hartshorn was not new and patentable at the date of his original letters patent.

Second, that the devices made use of by the defendants are no infringement of the plaintiff's invention.

To sustain the defense of want of novelty, the defendants rely upon evidence of the prior existence of what is well known as the coach fixture, in which a cord is used to lift the pawl and disengage it from the ratchet when it is desirable to allow the curtain to roll up under the action of the spring. This defense is fully met and answered in the two cases above cited, to which it is only necessary to refer to dispose of this branch of the defense.

The fixture manufactured by the defendants has a spindle which rests in the bracket, and is extended for a short distance into one end of the curtain roller, which end revolves around that portion of the fixed spindle which is projected into the roller, while the other end of the roller is provided with a journal, upon which it revolves freely in the supporting bracket. This spindle is provided with a cam-shaped recess on one side of it, within the roller, and a chamber of sufficient size to receive a small sphere or buckshot in such a position as to be directly over the recess in the spindle when the roller is revolved. The small ball or buckshot is introduced into this chamber. One edge of the recess in the spindle is so constructed that when the ball falls into the recess it will be forced against the side of the chamber, and operate as a detent to stop the revolution of the roller when it is turning one way. The other edge of the recess is so formed that when the roller is turned in the opposite direction the ball is thrown up into the chamber, where, when the roller is rapidly revolved, the ball is held by centrifugal force.

It will be seen, by a comparison of this contrivance with the one described in the Hartshorn patent, that it effects the same result by means of the ball operating as a detent as is effected in the Hartshorn contrivance by the pawl and ratchet In Hartshorn's, the pawl has a tendency to fall by gravitation into the notches made in the periphery of the hub, or when fixed below the hub, in one of the modes described in the patent, it is actuated by a spring which tends to engage it in the notch. The ball operates as a detent, catch, or pawl, to engage with the notch or ratchet whenever the rotation of the roller, and the upward movement of the curtain under the influence of the spring, are checked by the manipulation of the curtain or shade itself. In Hartshorn's, when the roller is revolved rapidly, the ratchet has not time to fall by gravitation into the notch while the ratchet notch is passing under the toe of the pawl. In Shorey's, while the roller is being rapidly revolved, the ball is kept by centrifugal force from engaging as a detent between the side of the chamber in the roller, and the edge of the recess in the spindle.

The construction of the claim in the Hartshorn patent was fully given in the case of Hartshorn and Almy. It was there shown to embrace, in combination with a spring roller, such an arrangement of pawl and ratchet, with the varying speed of the revolution of the roller mutually acting with each other through the manipulation of the roller, that the pawl would engage with the ratchet by checking the rotation of the roller and the upward movement of the curtain by the simple manipulation of the shade, merely varying the speed of the rotation of the roller. It is equally within the scope of this invention, whether the force which determines the fact of engagement or non-engagement of the pawl or detent with the notch or ratchet be that of a spring, or force of gravity, or centrifugal force.

Improvements may be made in the spring or the roller, the shade, or the form of the pawl or detent, and these improvements may be patentable; but so long as the combination embraces, as in the case of the device of these defendants, every element of Hartshorn's invention, operating substantially in the same manner to produce the same result, it must be treated as an infringement.

Decree for complainant, for injunction and account.

[*S. D. Law*, for complainant.
A. K. P. Joy, for defendant.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From February 29 to March 27, 1876 inclusive

APPLYING MOTIVE POWER.—J. Doubler, Philadelphia, Pa.
BAKING POWDER.—Dodge *et al.*, New York city.
BARBED FENCE WIRE.—H. W. Putnam, Bennington, Vt.
BOILER.—D. L. M. Moore (of New York city), London, England.
BOILER TUBE APPARATUS.—J. H. Faxon, New York city.
BOOT-SCREWING MACHINE.—American Cable Screw Wire Co., Boston, Ms.
BOOT-SEWING MACHINE.—D. Mills (of Brooklyn, N. Y.), Aston, England.
BRICK KILN, ETC.—G. S. Redfield, Chicago, Ill.
BRICK MACHINERY.—C. S. Bigler, Harrisburgh, Pa.
BRICK MACHINE.—W. A. Graham, Carlisle, Pa.
BURNING LIME, ETC.—A. Smith, Buffalo, N. Y.
CARDING MACHINE.—J. F. Foss, Lowell, Mass.
CLEANSING WHEAT.—D. M. Richardson, Detroit, Mich.
COVERING UMBRELLAS.—J. P. Onderdonk, Philadelphia, Pa.
CUTLERY.—J. Pedder *et al.*, Beaver Falls, Pa.
ENGINE VALVES, ETC.—H. E. Marchand, Pittsburgh, Pa.
FARE REGISTER.—J. Sangster *et al.*, Buffalo, N. Y.
FEEDING CARDING MACHINES.—W. T. Bramwell, Terre Haute, Ind.
FLUID METER.—J. C. Guerrant, Danville, Va., *et al.*
GASELIER.—C. Deavs, New York city.
HAY KNIFE, ETC.—H. Holt, East Wilton, Me.
HEAT RADIATOR.—E. C. Angell, New York city.
HORSESHOE MACHINE.—J. A. Burden, Troy, N. Y.
KNITTING MACHINERY.—C. J. Appleton, Elizabeth, N. J.
LIFE RAFT.—N. H. Borgfeldt, New York city.
LIGHTING GAS.—H. B. Stockwell *et al.*, Brooklyn, N. Y.
MACHINE GUN.—W. Gardner, Hartford, Conn.
MAKING GAS.—M. H. Strong, Brooklyn, N. Y.
MAKING LEATHER.—C. L. Royer, San Francisco, Cal.
MAKING PIG IRON.—C. Hinrod, Youngstown, Ohio.
MAKING STEEL.—W. Fields, Wilmington, Del.
MINER'S PICK.—J. I. Fewkes, Philadelphia, Pa.
PAPER BOX.—B. Osborn, Newark, N. J.
PHOTOGRAPH APPARATUS.—W. A. Brice, New York city.
PIANOFORTE.—C. E. Rogers, Mass.
PITH VENEERS.—S. H. Penley *et al.*
RAILWAY SWITCH, ETC.—J. S. Williams, Riverton, N. J.
ROLLER SHUTTER.—J. G. Wilson, New York city.
ROLLER SKATE.—C. H. Green, New York city.
SCREW WRENCH.—O. T. Bedell, New York city.
SEWING MACHINE.—G. L. Du Laney, New York city.
SOAP.—S. S. Lewis (of Boston, Mass.), London, England.
SUBMARINE TELEGRAPH STATION.—R. F. Bradley, Moffettsville, S. C.
TYPE-SETTING MACHINE, ETC.—S. W. Green, New York city.
VARNISHING METAL CASES.—F. A. Pratt *et al.*, Hartford, Conn.
VENTILATING MINES.—F. Murphy, Streator, Ill.
WASHING MACHINERY.—C. W. Littlefield, Boston, Mass.
WIRE BOOT PEG MACHINERY.—O. L. G. Noble *et al.*, Chicago, Ill.
WRINGER.—C. W. Littlefield, Boston, Mass.

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Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COTTON PLANTER.

Thomas R. Wallis, Egg's Point, Miss.—The novel feature in this consists in the axes of the seed cylinders (which are placed within a diamond-shaped harrow frame), being secured to bars, and these last being attached to two standards on said frame, thus forming a new mode of sustaining said cylinders.

IMPROVED GRAIN DOOR.

Joshua W. Merriman, Wells, Minn., assignor to himself and Benjamin F. Smith, same place.—This consists of a vertical catch bar mounted at its upper end on an eccentric stud of a hand lever. At the lower end there is a slot working on a stud pin, the slot being so inclined that, when the eccentric stud is worked to raise and draw back or lower and push forward the upper end of the catch bar, the lower end will work in the same manner. The bar thus holds one end of the grain door by being pressed into a groove in the door frame, binds the door fast, and prevents it from shaking, and at the same time locks the door against rising.

IMPROVED ROTARY CHURN.

Israel Solt, Lithopolis, O.—This invention consists in using with a square churn a dasher having its blades straight on outer edges, concave on inner edges, and provided with concavo-convex slots, the same being applied to cross bars. This dasher, by its inner concave and outer straight edge, catches all the cream and throws it to the center of the churn, so that the butter globules are forced back and forth through the slots and quickly broken.

IMPROVED COLTER.

Kinyon W. Manwaring, Council Bluffs, Iowa.—It is here proposed to mount the colter, between two right and left nut collars, on a shaft which revolves on end bearings in the yoke which attaches the colter to the plow. The objects are to adjust the colter along the shaft readily for wide or narrow cuts, and to arrange the bearings so as to withstand wet and exclude the dust better than when the colter revolves on a stationary shaft, as commonly arranged.

IMPROVED HORSE HAY RAKE.

Daniel D. Dunn, Greenwich, Conn.—This relates to improvements in horse hay rakes, by which the different operations of the rakehead-governing parts may be accomplished in a simpler manner. The invention consists, first, in applying the swinging rakehead in front of the supporting axle; secondly, in attaching the clearer bar; thirdly, in combining the rakehead-operating lever rod and back piece with a treadle, in such a manner that the horizontal position of the same is secured during its motion; and lastly, in the combination of the rakehead-operating lever rod with a fulcrumed foot lever, for securing the rake in raised or lowered position.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED ENVELOPE MACHINE.

Henry D. Swift and Daniel W. Swift, Worcester, Mass., assignors to G. Henry Whitcomb & Co., same place.—This machine includes thirteen new devices, mainly improvements upon an apparatus which was the subject of a previous patent granted to the same inventors. The edges of the blanks rest on a raised form, and the blanks are removed by a gummed lifter. There is new apparatus for applying the gum very smoothly, for keeping the gummed flap separate from other parts during folding, and for adjusting the mechanism to envelopes of varying thickness, beside novel constructive details of much ingenuity, which would require the aid of engravings for their proper elucidation.

IMPROVED TYPE WRITER.

Philander Deming, Albany, N. Y.—This relates to such an improvement in the type writers lately introduced into use that the same may be made available for verbatim reports by a separate marking lever, that prints outside of the printing point of the common type levers, and is operated by an adjustable button attacked to the space key. As soon as the marker is joined to the space key, it may be worked by the palm of the hand simultaneously with the striking of the initial key, and thereby verbatim reports made in stenotypic manner by means of the simple and inexpensive marker arrangement.

IMPROVED MAGNETIC MACHINE.

Jerome Kidder, New York city.—This invention consists in hinging the support of an electrical coil in its relation to a galvanic battery in such a manner that, when the coil is turned or swung in one direction, the circuit will be closed with the galvanic battery and when swung in the other direction, the said circuit will be opened.

IMPROVED PAINTERS' SCAFFOLD.

William Hoehn, New York city.—This platform may be carried from place to place and mounted without injury to the stiffening brace rods. The novel feature consists in longitudinal brace rods that are applied by tightening screws by supporting end clips, and to laterally braced arms or stays, which are hinged to the platform to fold with the rods to the under side of the same.

IMPROVED COAL BREAKER.

David Clark, Hazleton, Pa.—The construction of this breaker is such that, should a substance harder than coal or slate get into the breaker and break the safety devices, a roll will be thrown out of gear, and will remain out of gear until the damage is repaired and the said roll again adjusted in place.

IMPROVED WAGON JACK.

Albert E. Van Horn, Sebewaing, Mich.—A ratchet wheel operated by the lifting lever has a slotted projection in which enters a pin on the movable bar of the jack. The pawl falling out, the teeth of the wheel hold the load at any desired position.

IMPROVED JIG SAW.

Peter Hughes, New York city.—This is a novel spring contrivance and an elbow foot treadle for working the saw gate, whereby a simple and efficient mechanism is provided for working a jig saw.

IMPROVED ROCK DRILL.

William H. Wright, Sunbury, Pa., assignor to himself and John Wright, same place.—The object of this invention is to provide for miners a drill for boring coal and rock, that is attached directly to the material to be drilled, without props or supports, and which allows the change of drills to suit the depth of bore hole and material without removing the frame. A frame is provided with stationary or adjustable prongs and a sectional screw nut with link for interchanging the drill.

IMPROVED FRICTION CLUTCH.

Edwin F. Williams, Bald Mountain, Col. Ter.—This invention consists of brakes which are drawn against the face of a disk wheel by wedges, moved by the sliding head on a shaft, which in turn is moved by levers.

IMPROVED GRINDER FOR MOWERS.

Walter B. Grosh, Reading, Pa.—This consists of a supporting frame for the grinding wheel, fixed on pivots so as to shift readily to let the stone run in different angles of the opposite edges of the cutters. The frame has articulations whereby the grinding wheel may be moved forward and backward along the edges of the cutters at the same time that it is rotated for grinding them. There is, besides, a new clamp for holding the cutting bar so as to adapt the face of the grinding wheel to edges of different bevels.

IMPROVED JOINERS' BENCH VISE

George H. Wheeler, Great Barrington, Mass.—In this invention, a jaw is fitted to slide in a plate attached to the end of the bench, and connected with a foot lever for closing up on the work by foot power. A ratchet bar is arranged in connection with the lever for fastening it to keep the jaw closed. The jaw can be opened and closed much quicker than when worked by a screw, and it is always parallel to the work and the bench. The slide is connected to the lever by a rope passing over a pulley, which will, in practice, be mounted on the plate on which the jaw slides.

IMPROVED PLUG TOBACCO MACHINE.

Thomas F. Morrin, Jersey City, N. J.—This is an improved machine for pressing tobacco leaves to form plug tobacco, splitting it into strips of the required width, and cutting said strips into pieces or plugs of the desired length.

IMPROVED MACHINE FOR MAKING TACKLE BLOCKS.

Frederick S. Burr, Brooklyn, N. Y.—This is a combination of apparatus whereby the sides of wood tackle blocks may be bored and dressed to shape, either for rope or metal bangers, automatically in one machine, so as to economize largely in labor of repeatedly handling them.

IMPROVED MACHINE FOR MAKING TWIST DRILLS.

Edward S. Taber, New Bedford, Mass.—This is a machine for making twist drills with increasing pitch or inclination of the grooves. A spiral groove is made in the mandrel which revolves the blank, and advances it along the cutters which make the spiral or twist grooves. In said groove the key of the wheel which turns the mandrel works, so that, as the mandrel rises along the key, its rotation diminishes proportionately to the advance, and so increases the pitch of the twist.

IMPROVED VALVE COUPLER FOR OIL WELLS.

William Walker, Baldwin, Pa.—By this device, two or more valves may be coupled and worn out before the drawing of the sucker rods is required. A coupling section is screwed to the top of the lower plunger, which is lowered into the barrel and connected by a threaded top stem, with an interior threaded section that is applied to the bottom part of the next plunger to be screwed to the lower section, when the reserve valve is to be brought into operation. A jam nut with notches is placed on the stem of the lower section, and engaged by lugs of the upper coupling section to be screwed down with the same, for connecting the sections.

NEW HOUSEHOLD ARTICLES.

IMPROVED WASHING MACHINE.

Leander Becker, York, Pa.—This invention relates to certain improvements upon the patent granted to the same inventor June 29, 1875, and numbered 165,058: and it consists in the particular construction of the rubber, which is made of corrugated boards fastened in metallic end frames by lugs and screws, and provided with studs by which the rubber is supported in the oscillating frame.

IMPROVED STEP-LADDER.

Silas C. Blauvelt, Blauveltville, N. Y.—This device may be readily arranged for use as a step-ladder or as an ordinary ladder, and may be folded together for storage and transportation, and, when adjusted for either purpose, will be held securely in place. In the curved edge of semicircular blocks on one part are formed three notches, in such position as to receive a pin and lock the parts together.

IMPROVED SCRUBBER.

John Deasey, Fall River, Mass.—To a scrubbing brush are attached side pieces that are supported by wheels. The action of a handle on the side pieces produces, in connection with the supporting wheel, considerable lever power on the brush, so as to press the same firmly on the surface to be scrubbed, and clean the same effectively.

IMPROVED WASHING MACHINE.

Benjamin Tarr, Evanswood, Wis.—This consists of an octagonal vessel made of slats into which the clothes are introduced and revolved in the suds box. Inside the vessel are several hard wood blocks. There is a novel arrangement for supporting the cover which constitutes an additional washtub when thrown back.

IMPROVED PRIVY SEAT.

Branch Tanner, Cheneyville, La.—This consists of an oscillating seat with swinging front and rear aprons, of which the front apron is used for watercloset purposes when the seat is swung back below a stationary inclined cover at the rear.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SHADE FOR HOP BOXES.

Hiram Niles Harrington, Wilson Place, N. Y.—This invention consists of the connection of the hop box by upright standards with adjustable shades, supported and braced so that the hops and pickers are protected against sun, rain, and wind.

IMPROVED COTTON PLANTER.

Augustus T. Hatcher, Mansfield, La.—This is an improved cotton planter, the operating mechanism of which may be applied to the stock of an ordinary scooter. It combines improved devices for opening a furrow to receive the seed, dropping the seed, and covering it.

IMPROVED OX YOKE.

Eli A. Farr, Cedar Springs, Mich.—This invention combines with the main beam of a double neck yoke, a central draft staple, and brace rods, vertically adjustable to greater or less depth on the beam, to regulate hight of draft.

IMPROVED MILK COOLER OR WARMER.

David D. Whitaker, Carthage, N. Y.—This consists of a milk pan set into a rack with air space all around, which is cooled by zigzag bottom pipes and side pipes, connected to an ice water dish above the pan. The whole is covered by a cloth screen, to keep the cold air confined.

IMPROVED ROOT-CUTTING PLOW.

John S. Swaney, Marengo, Iowa.—This plow is adapted for cutting off the bottom and side roots of hedge, apple, and other seedlings and trees in taking them up.

IMPROVED EXPANSION REEL FOR REAPERS

Alfred W. Shaw, Chatham Center, Ohio.—This reel is so constructed that it may be conveniently expanded and contracted to work closer to and farther from the cutter bar and ground, without stopping the machine and without changing the tension of the driving belt.

IMPROVED PLOW.

Robert A. J. Armstrong, Knoxville, Tenn.—This consists in a mold board, having oblique sockets for share and point, in combination with a triangular share keyed thereto, and a bifurcated point without fastening, but supported by the share. With this construction, when the lower side of the edge of thesh are and point become worn, they can be easily detached and reversed, so that they will be self-sharpening, and when worn thick they can be easily sharpened and tempered separately.

IMPROVED HULLING MACHINE.

George H. Peabody, Brooklyn, N. Y.—This invention consists in the combination of disks, provided with alternate concaved and flat emery surfaces and wheels provided with alternate convexed and flat emery surfaces. The disks and the wheels are revolved in opposite directions and at different velocities, so as to rub off the hulls as the kernels pass through the machine.

IMPROVED INSECT-DESTROYING COMPOUND.

George Thomas Johnson, Pittsylvania Court House, Va.—This invention contemplates the application of a finely divided poison to the leaves of the tobacco plant, in order that it may be taken by the insects and destroy their lives. In consists in mixing kerosene oil, turpentine, and sulphur, in such proportions that it will not be refused by the insects, while its effect will be their certain and inevitable destruction.

IMPROVED PLOW.

Peter G. Johnson, Hoopeston, Ill.—This invention is an improvement in the class of riding or sulky plows whose trucks are provided with a bent or cranked axle. The improvement relates particularly to attaching the plow to a bail-shaped lever which is pivoted to the truck and raised and lowered as occasion requires.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BRONZING MACHINE.

Christian Landolt and Frederick Wichser, Tell City, Ind.—This bronzing machine consists of a flexible stencil combined with a sliding work table, bronze box, and bronzing pads, in such manner that the stencil rolls down and lies on the work at the same time that it is moved under the bronzing pads, and rises off as the table is moved back to take off the work, when the bronze box moves up to the pads and supplies them. It is a simple contrivance whereby cards, bills, etc., may be wholly or partly bronzed.

IMPROVED BOTTLE STOPPER.

Albert Freygang, New York city, assignor to Frederick Knief, same place.—This consists of a swinging bail that carries at its top part a stopper head with slotted vertical top plate and a recessed eccentric cam lever. The latter forces the stopper head down and retains it in the mouth of the bottle by its straight part bearing across the stopper head. The lever is taken hold of by the hand, holding the neck of the bottle when emptying the same, and the stopper is thereby retained easily without any chance of dangling about the mouth of the bottle and interfering with the pouring out of the contents.

IMPROVED BOTTLE STOPPER.

Adolph Luthy, New York city.—This is a stopper applied by the neck band, and made of one piece of rubber, extending from the neck band to and over the mouth of the bottle, so that the swinging yoke with loose sleeve, fitting in a top groove of the stopper, readily closes and opens the same.

IMPROVED BURIAL CASE.

Oscar J. Case and Edwin R. Richardson, Auburn, N. Y.—An improved glass burial case has the lid made in two sections, which are secured by side lugs and pins to guide projections at the outside of the case. The handles or knobs are made in one piece with the sides.

IMPROVED SHIRT.

William H. H. Tracy, Troy, N. Y., assignor to himself and Frederick Spaulding, same place.—This shirt is so constructed that the parts of the bosom will not be drawn out of position and shape by the working of the side parts of the front. The bosom is left free at its side edges, but attached to the body at the top and bottom edges and along the central line.

IMPROVED SHIRT.

Morris Popper, New York city.—This invention proposes to furnish partly made shirts, in which the parts that require skill in putting them together shall be properly sewn, while the long seams of the sides and sleeves, that require no particular skill, shall be left unsewn. The sleeves are to be without cuffs, so that they may be cut to the length required for the arms of the wearer.

IMPROVED MIDDLINGS PURIFIER.

Edwin N. Lapham and Joseph Lapham, Peru, N. Y.—A hollow trunk, which stands nearly upright, has stationary beaters extending across and located in groups along the upper portion. The lower side has passages for the escape of the middlings into a spout for conducting them away, the passages being regulated by valves. The trunk bends over into a horizontal portion, in which are other stationary beaters, and below them is a hopper for returns. From the inlet the middlings are blown up along the trunk against the beaters by a fan, the light particles being separated and carried off to the bran bin, while the heavier portions fall through the valves, and the returns go back to be worked over again.

IMPROVED NECKTIE HOLDER.

Max Rubin, Brooklyn, E. D., N. Y.—To the inner side of the tie is secured a metallic plate, which has a transverse slot formed in it. One end of the slot is made large enough to receive the head of the stud or button of the shirt neck band. The middle part of the slot is made of only sufficient width for the stem of the stud to pass through. The other end of the slot is made wider, but not wide enough for the head of the stud to pass through. A piece of elastic is interposed between the plate and the tie to hold the head of the stud pressed against the inner side of the plate, and keep it from sliding.

STICK FOR DIPPING STAMENS FOR ARTIFICIAL FLOWERS.

Ambrose Giraudat, Neuvy (Norwood P. O.), N. J.—The two parts of the sticks are made of the usual size. To the end of the lower part is attached a hook, which enters and fits into a slot in the end of the other part to lock the said ends together. Through transverse holes are passed strips of spring metal, the ends of which are bent upward so as to lock the two parts. To the face of one part, near its side edges, and to the face of the other part, at its center, are attached cords, to hold the threads securely. With this construction, the stick can be readily and quickly applied to the threads, and will hold them securely while being dipped in the paste.

IMPROVED APRON.

Joseph Malonzo, Great Falls, N. H., assignor to himself and Frank Malonzo, same place.—This consists of a sheet of patent leather, constructed in the form of an apron, but contracted in the portion to fit the waist by gore slits cut in it and sewn up. A waist band is attached so as to serve for a holder for the weaver's shears and reed hooks. The device is designed to protect the clothes of the weaver from the wear of the front beam.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export & Domestic Use. R.H.Allen & Co., N.Y.

Manufacturers of Circular Saw Mills, please send Description and Price List to Jos. Minchener, Troy, Ala.

Wanted—Small clean iron castings. Makers, send address, Box 3, No. 160 East 48th St., New York.

For Sale—Two Hydraulic Presses, with double power pumps, new; 12 in. ram, 3 ft. lift, clear space 8 ft., platen 48x82. Also three new Power Elevators, Merrick's make, below cost. John Howard, No. 1720 Rittenhouse St., Philadelphia, Pa.

For Sale, cheap—The Pneumatic Machinery used in Sinking Piers at South St. Bridge: Compressor, Engine, Knowles Pump, Receiver, Gauges, &c., all perfect and complete. Address F.W.Getz, 420 Library St. Phila.

For Sale—Half or whole interest in a manufacturing business (patented), together with the machinery. Address G. P. T., Box 71, Baltimore, Md.

Steam Engines—25 per cent extra power or saving in fuel, guaranteed, by applying the R.S. Condenser. T. Sault, Consult'g Eng'r, Gen'l Agt,. New Haven, Ct.

Wanted—An exclusive Agency for the sale of a first class patented article or machine of practical utility. Address H. C. Goodrich, 205 State St., Chicago, Ill.

Wanted—To Manufacture on Royalty or Buy a good and cheap Corn Sheller. Address Girdwood & McLellan, Ashville, N. C.

Leather and Rubber Belting, Packing and Hose. Greene, Tweed & Co., 18 Park Place, New York.

Wanted—A small machine that will, by touch, register, one at a time, the number of articles handled. Address Edwin A. Simonds, Erie, Pa.

For Sale—Engine 20x36, one 16 ft. Engine Lathe, one large Blower, four dank Engines, two Steam Pumps. Bull & Co., Indianapolis, Ind.

The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-32 to ½ horse power. Agents wanted Address, with stamp, 1113 Chestnut St, Philadelphia, Pa.

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Wanted—Manufacturer of Iron Tools or Steam Engines, to take part of Salesroom with a long established firm in this city. Expenses light. Address H., P. O. Box 4779, New York City.

Sure Cure for Slipping Belts—Sutton's Patent Pulley Cover is warranted to double the power of any pulley. Circulars Free. Agents Wanted. John W. Sutton, 95 Liberty St, New York.

Scroll Saw Blades, best quality, made to order, and Sheet Steel cut to pattern, by A. Coats, 108 Hester St., New York City. Send for List.

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For Sale—At a great Bargain, Grain Elevator, Hay Press, and Warehouse, all in excellent repair and good location. Address C.A.Gleckler, Farmington, Iowa.

Machinist's Tools, second hand, which must be sold in order to close up an old partnership. For pamphlet, giving full description of each tool, address Steptoe, McFarlan & Co., 214 West 2nd St., Cincinnati, Ohio.

Baxter Wrenches fit peculiar corners. Prices reduced. Greene, Tweed & Co., 18 Park Place, N. Y.

The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Vertical Tubular Boilers, all sizes. Send for price list. Lovegrove & Co., Philadelphia, Pa.

Centennial Exhibitors, buy your Belting in Philadelphia, from C. W. Arny, 148 North 3d St., and save freight and trouble. Satisfaction guaranteed.

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Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

American Metaline Co., 61 Warren St., N.Y. City.

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For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Patent Scroll and Band Saws, best and cheapest nuse. Cordesman, Egan & Co., Cincinnati, Ohio.

The Original Skinner Portable Engine (Improved), 2 to 8 H.P. L. G. Skinner, Erie, Pa.

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Our new catalogue of drawing materials will be sent on receipt of 10c. Add. Keuffel & Esser, New York.

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All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

For Best Band and Scroll Saws, Universal Wood Workers, Planing and Matching Machines, address Bentel, Margedant & Co., Hamilton, Ohio.

Wind Mill Rights Cheap—One county in each State to give for introducing the mill. For terms, &c., address E. S. Smith, Good Hope, Ill.

Wanted—Address of Makers of Papier Maché Ceilings. Address J. Parmelee, Des Moines, Iowa.

Corner Cutting Machine, Chocolate Mill, Bolt Cutter, Letter Press and Stand—all at Bargains. A. B. Cohu, 197 Water St., New York.

Hamilton Rubber Works, Trenton, N. J., Manufacturers of ¾ pavement Hose, and any size, also Belting, Packing, Car Springs, and Rubber for Mechanical use. Send for price list.

Notes & Queries

C.S.R. will find that celluloid is a substance suitable for his purpose. See p. 23, vol. 33.—C. H. D. will find a good description of soluble glass on p. 148, vol. 33.—F. H. will find a description of the transfer fluid, for transferring engravings to wood, etc., on p. 138, vol. 30.—M. M. will find directions for preserving natural flowers on p. 204, vol. 28.—F. L. W. will find directions for stuffing birds on p. 250, vol. 30.—B. W. B. will find directions for setting carriage axles in this issue.—N. D. will find a recipe for hydrofluoric acid, for embossing glass, on p. 203, vol. 33.—M. G. will find an explanation of the difference between the hights of the tides in different localities on p. 65, vol. 28.—D. W. G. will find a formula for safety valves on p. 107, vol. 31.—A. B. F. will find a description of a Bunsen burner on p. 387, vol. 33.—N. S. will find directions for making a sun dial on p. 409, vol. 29.—F. W. D. will find directions for silverplating without a battery on p. 408, vol. 33. For a similar gold plating, see p. 116, vol. 33. For silverplating with a battery, see p. 133, vol. 30.—G. G. will find a good recipe for black ink on p. 92, vol. 33.—J. F. A. can caseharden his steel cams by the method described on p. 69, vol. 31.—M. S. can prevent an accumulation of rust on his machinery by following the directions on p. 169, vol. 33.—W. E. D. will find a good recipe for gold lacquer on p. 240, vol. 34.—A. S., J. H. T., A. J. W., Jr., J. McC., E. G. P., A.L., W. H., and J. K., who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) P. M. H. A. K. asks: How many horse power will it take to run a 60 inch circular saw through a 2 feet log of hemlock or oak? A. Ordinarily about 10 horse power to every 1 inch of feed in each revolution of the saw. In order to give anything like a correct estimate, the amount of feed to each revolution, the number of teeth, and speed of the saw should be given. Sixty inch saws are run to cut all the way from 5,000 to 40,000 feet of oak and hemlock per day.—J. E. E., of Pa.

(2) A. B. W. asks: 1. Of what size and of what kind of glass should a lens be to take a photograph 2 feet square, the object to be about 18 to 20 feet from the glass, and the focal distance 2 or 3 feet? A. You should have a photographic view camera of 2 feet focal length. The size of the glass may be two or three inches diameter. 3. Could such a photograph be taken easily? A. Not very. 3. Please give me a process for taking negatives on glass. A. Consult some text book on photography.

(3) F. F. says: I see in the SCIENTIFIC AMERICAN SUPPLEMENT mention of a meteor which passed near Boston on February 5. The article says that, "after traversing a path which consumed a second in time," it gradually slackened speed, and finally became motionless. At the speed at which it must have been moving, how could it have become motionless? A. The article says that the meteor moved from east to south, which implies a change in its line of motion, so that, when the direction was in the line of sight, it became motionless to the observer. This was probably caused by the body being deflected by the resistance of our atmosphere.

(4) N. A. E. asks: How can I use crayons on drawing paper without leaving streaks? A. An even tint can be produced by using the tip of the finger, or a small pointed piece of india rubber, or a paper or leather stump, to be bought of a dealer in drawing materials.

(5) X. Y. Z. asks: What are coprolites? A. They are the fossil excrements of extinct animals, and are found in immense beds in some countries. They are valuable as manure.

(6) H. T. asks: Is it possible that a direct-acting steam pump can work with a variable cut-off so that the steam expands down to 15 lbs.? A. We know of no direct acting pump having a variable cut-off.

(7) J. W. asks: 1. Will a cupola 6 inches in diameter be large enough to melt and run into one piece 20 lbs. of cast iron? A. No. 2. What is the largest amount it will run into one piece? A. It might run 10 lbs. 3. The bottom of the coal and iron door is 3 feet 2 inches above the bottom of the cupola; is this hight sufficient? A. Yes, for the diameter of the cupola.

(8) G. W. C. asks: 1. Is there such a thing as a drill for drilling square holes? A. No. 2. Is there any probability of one being invented? A. No.

(9) C. S. C. asks: 1. Is tool steel the best for making tuning forks? A. Yes. 2. What temper is required? A. Temper it to a blue.

What grade of soft iron is best for electro-magnets? A. Ulster or Norway iron is best.

(10) B. S. says: I have a portable engine, and the boiler is cracked. The crack is about two inches long: it is situated just above the grates, near the mud valve, and it leaks slightly. Is there any way of stopping the leak without having the boiler patched? A. Cement may be used. See p. 331, vol. 32. The best plan is to patch the boiler.

(11) F. L. asks: What is the safe working pressure for a boiler made of wrought iron gas pipe, of 2 inches internal diameter? A. You can carry 100 lbs. per square inch.

(12) G. C. W. asks: Will white lead harden under water? A. No.

(13) A. asks: 1. Will copper, when melted, flow as freely as lead? A. No. 2. Will copper give as good an impression of the mold as lead? A. No. 3. Will a black lead crucible stand sufficient heat to melt copper? A. Yes.

(14) W. M. B. asks: Would the wear from friction on a pulley be greater in using a wire band than with a leather belt? A. Yes.

(15) F. D. L. asks: Is there any flux, welding compound, or means whereby a steel face can be united to the jaws of a cast iron vise by putting the steel in the mold, and pouring thereon molten iron? A. Steel faces are welded to cast iron in the way you mention, without the employment of any flux.

(16) W. S. F. asks: Is there any other way of making steel name stamps than with a chisel? A. We know of no way of making them save with chisels and files, but they could no doubt be stamped with suitable dies.

(17) H. D. S. S. asks: Is there a machine shop in the country that has the capacity of building two locomotives a day? A. We know of none.

(18) P. E. L. asks: Can cone friction couplings be used on a shaft running at 140 revolutions per minute, transmitting 30 horse power, one part of the coupling to have a lever attached to throw the same in and out of gear while running? A. Yes. Friction pulleys will answer the purpose well.

(19) W. H. C. asks: By what process may cast steel be annealed so that it can be easily cut with a chisel? A. Heat it slowly to a cherry red, and let it cool off, well covered with slaked lime.

(20) J. S. M. asks: 1. Is the pump on an engine to force the water into the boiler? A. Yes. Where is it generally situated? A. Beside the boiler. 2. By what means is it worked? A. By an eccentric, cam, or crank.

(21) E. G. asks: How can I keep cider sweet for the market? A. If after the first racking the fermentation still continues, it is better that the operation should be repeated as often as any scum rises to the surface. The final racking should be performed in fine weather. When the bottles are filled they should be set by, uncorked, until morning, when the corks must be driven in tightly, and secured by wire and melted rosin or any similar substance.

(22) B. asks: What is the best method of calcining borax? A. Put it in a capacious cast iron pan over a moderate fire.

(23) F. B. M. asks: How can white lead paint be made from old lead pipe? A. Roll the lead out into a thin sheet and place it in an earthen pot with a little vinegar in the bottom. Then bury the pot in fermenting stable dung or spent tan bark. The acetic acid of the vinegar corrodes the metal, forming a superficial coating of acetate of lead. The carbonic acid set free by the decomposing vegetable matter displaces the acetic acid, combining with the lead and forming the carbonate (white lead). The acetic acid thus released attacks more metal, which is again carbonized, and thus, with a small charge of vinegar, the operation is continued a long time, and a large quantity of lead changed into carbonate.

What is the weight of a medium-sized locomotive? A. About 30 tuns, with the tender.

(24) J. C. R. asks: How can I mold chalk? A. Ground chalk, if moistened with a little gum water, may be pressed into a mold in a compact mass, by means of hydraulic pressure.

(25) G. M. Jr., asks: What is the process of making deodorized alcohol or cologne spirit from common alcohol? A. Alcohol employed in perfumery should be free from all smell of fusel or other oils. Atwood's (patent) alcohol is deodorized by distillation over permanganate of potassa. Spirit of wine, brandy, and alcohol distilled over soap lose their empyreumatic odor and taste entirely. At about 215° Fah., the soap retains neither alcohol nor wood spirit. The empyreumatic oil which remains in combination with the soap which forms the residuum of the distillation, is carried off at a higher temperature by the watery vapor, which is formed during a second distillation, the product of which is a soap free from empyreuma, and is fit to be used again for similar purposes. The concentration of the alcohol increases in this operation more than when the soap is not employed, because this compound retains the water, and the alcoholic vapors which pass over are more concentrated. Thirty-three pounds of soap are enough for one hundred gallons of empyreumatic brandy; and direct experiment has shown that, under the most favorable circumstances, the soap can retain 20 per cent of empyreumatic oil. The soap employed should contain no potassa; it should be hard or soda soap, and ought to be completely free from any excess of fatty acids or fluids, otherwise it may render the product rancid or impure. Common soap, made with soda and oleine, has satisfied all the conditions in practice. If this soap is employed, it is better to add a little soda during the first distillation.

(26) C. A. asks: 1. Would a horizontal engine 2x8 inches propel a boat, large enough for 2 persons, up stream? A. You could use this engine in a boat 20 feet long. 2. What size of boiler would she want? A. Make one 2½ feet in diameter and 4 feet high. 3. What speed would she make? A. Probably 5 or 6 miles an hour.

(27) A. L. asks: How can I vulcanize caoutchouc? A. Parkes' method is now generally adopted. The caoutchouc is immersed in a mixture of 30 parts of bisulphide of carbon and 1 part of chloride of sulphur. It is next placed in a room heated to 70° Fah.; and when all the sulphide of carbon has been volatilized, the process is so far complete that it is only requisite to boil the material in a solution of about 18 ozs. of caustic potassa to 2 gallons of water, the vulcanized caoutchouc being next washed to remove excess of alkali.

(28) C. S. A. asks: Please explain how the jetties at the mouth of the Mississippi river are made. A. See p. 273, vol. 32.

Are they now at work on the tunnel between New York and Jersey City? A. Yes.

We have some glasses that were dipped into water with milk on them; the hot water seemed to set the milk, leaving a milky stain on the glasses, that we cannot wash off. How can we make the glasses look clear again? A. Try a little common washing soda.

How is dry steam made? A. By using a well constructed boiler or a superheater.

(29) D. R. asks: 1. In tinning brass, which is the best method, by cream of tartar boiling or by protoxide of tin solution? A. The cream of tartar method is in more general use. 2. What is the time required to do it? A. It varies from 10 minutes to half an hour, and sometimes longer. 3. In polishing smooth sheet brass to a high finish, how shall I prepare my wooden wheel after the leather is applied to the rim? A. Glue emery to the cutting wheel; and for polishing, use a brush wheel and a rag buff to finish with.

(30) J. M. asks: 1. How much incline per foot should an electro-copper plate have to insure success in arresting very fine gold dust? A. Amalgamated copper plates, set in sluices for obtaining very fine gold, are put at an incline of from 1 to 1½ inches per foot. 2. Do strata of red sand found in aluminum or modified drift generally contain gold dust? A. We believe so.

(31) W. J. G. asks: 1. Does it make any difference in the expansion and contraction of mercury, in a thermometer, whether the tube is sealed or not? A. Yes. 2. How can I regulate automatically the heat in a close box, so that I can secure a certain temperature? A. It can be done by heating the box with steam or water at a fixed temperature.

(32) R. C. asks: At how many revolutions per minute could I run with perfect safety a grindstone 6 feet in diameter and 8 inches wide on the face? A. It would not be well to run the stone faster than 75 or 80 revolutions per minute. This is on the supposition that the stone is as strong as a built-up millstone.

(33) J. G. R. says: I have an engine of 1 inch cylinder and 2½ inches stroke, and want to build for it a boiler which will make steam rapidly and which will stand about 25 to 30 lbs. pressure. Of what size, material, and form should it be? A. Make a cylindrical boiler 10 inches in diameter and 2 feet long. Copper is a good material; it should be about $\frac{1}{16}$ of an inch thick, with heads from ¼ to ⅜ inch thick.

(34) M. E. J. asks: Supposing a ball of immense weight to be rolled around on the surface of the earth, would it affect the center of gravity? If it did, suppose a ball of the same weight could be fired from a cannon around the earth without touching the surface, would that affect the center of gravity in the same way? A. The effect you mention would be produced in both cases.

(35) J. M. Y. asks: At what speed should water move in a draft tube under a water wheel to give the most power to the wheel? A. If you make the draft tube with the same area of supply, and allow it to dip into the water a few inches at the bottom, you will have a satisfactory arrangement, provided the tube is air tight. It is very important to attend to the latter point.

(36) J. F. B. asks: 1. Can water be raised 10 feet high by a wheel 10 inches in diameter, 3 inches wide, the floats being fastened on a square shaft? A. You will have no trouble in raising the water to that hight, with 100 to 150 revolutions a minute. 2. What should be the size of the pipe in which it is to be raised? A. A two inch pipe will answer very well.

(37) C. D. B. asks: If I let steam into a vessel of boiler plate, 2 feet in diameter and 6 feet long, to the pressure of 100 lbs. to the square inch, how long will it take for the same to lose its pressure? A. If the air surrounding the boiler is still, the radiation will take place at the rate of between 3 and 4 units of heat per hour for each degree of difference between inside and outside temperatures.

(38) S. P. S. asks: 1. How high may I carry the water in a boiler constructed with an inside case, without danger of filling the inside case? I wish to generate steam at the rate of 1 cubic foot per minute for each linear foot of the boiler, and the water is 6 or 7 inches wide at the water line. Will the water collect in the steam room to any great extent if the water line is kept 4 inches below the top of the case? A. You will have to make some experiments to determine this matter definitely. We imagine, however, that you will find it necessary to carry the water at least 6 inches below the top of the case. 2. We have an engine which runs at 120 revolutions per minute, with a fly wheel 8 feet in diameter, the rim being 14 inches wide and ¾ thick at edges, and 1¼ inches thick in the middle. We need to stop it sometimes quickly, and as the bottom of the wheel is close to the ground, I propose to use a brake. What pressure is it safe to put upon the wheel? A. You will probably find it safe to apply pressure equal to the tension of a belt on the fly wheel when the engine is doing its greatest amount of work, and this will be more than sufficient for your purpose.

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(39) C. S. P. asks: 1. What size of boat, ribless pattern, will be large enough to carry 12 or 15 persons? A. Make it 30 feet long and 6½ feet wide. 2. What size of boiler is necessary for an engine 4x6 inches? A. Make a boiler 3 feet in diameter and 4 feet high. 3. What size and pitch of propeller will be necessary to run the boat as fast as possible? A. Propeller 2½ feet in diameter and of 3½ feet pitch.

(40) T. K. G. asks: 1. Will a simple coil of pipe do for a superheater? A. Yes. 2. Can there be any joints in the same, either of malleable or cast iron, without the difference in expansion causing a leakage of steam? A. We think that such joints might be made tight. 3. Is a check valve necessary between the boiler and superheater to prevent the return thereto of the superheated steam, in case the flow of steam at the outlet was checked or retarded? A. Some kind of valve is required. 4. Why is there no economy in fuel in distilling in *vacuo*? A. There might be some trifling economy if the cost of maintaining the vacuum were not counted; but it would be very slight, as the diminution in the total heat of evaporation would be very little.

(41) W. G. says: I have a steam pump with a 22 inch cylinder, 700 feet underground, and I am obliged to carry the exhaust steam to the surface. Of what size should the exhaust pipe be so as not to have any back action on the engine? A. The exhaust pipe should have an area at least as large as the exhaust port of the engine. 2. What is the cheapest and best material to make it of? A. Make it of galvanized iron.

(42) R. J. M. says: 1. I am about to construct an engine with a 4x1 inch cylinder. What should be the size of the ports and exhaust? A. About $\frac{1}{16}$ of piston area. 2. How large a fly wheel would I need? A. From 9 to 10 inches in diameter. 3. What should be the size of the boiler, using charcoal for fuel? A. Make it 10 inches in diameter and 2 feet long. 4. Could I use a wood cylinder, allowing the wood to be half an inch thick? A. Not with satisfactory results.

(43) I. Y. asks: Does it make any difference how high a dam is on a stream of water if the wheel uses all the water? For instance, we have a mill running 10,000 spindles, and it holds the water just inside the dam and no more. We want to run 2,000 more spindles; would raising the dam give us any more power? A. Under the circumstances stated by you, raising the dam and doing nothing else would produce no effect on the power.

(44) S. T. M. asks: Why is the letter E placed on the left hand side of an ordinary surveying compass, transit, or similar instrument, and the W is placed upon the right? A. Some instruments are graduated with the E on the right, but the more usual arrangement is as stated in your question. We do not know who first adopted the graduation; but the reason for it is easily explained. Suppose a line to which the compass is directed has an E bearing; then in an instrument graduated like a mariner's compass, the N end of the needle would point to W, because in taking a bearing the needle is stationary and the graduated circle revolves; so that a bearing to the right of N is read off from N towards the left, and *vice versa*. Hence, if the instrument were graduated as in the mariner's compass, it would be necessary to reverse the readings before entering them in a notebook.

(45) E. R. asks: How can I fix gold on picture frame moldings? A. First give the wooden frame a coating of hot size and whiting; both articles must be of the best quality. Smooth this coat down with a pumicestone and water, and thoroughly dry. Melt some glue size in water, and apply with a soft camel's hair brush. Let dry, and wet a part at a time as required, and press the gold leaf on lightly, and blow on it with the mouth to level it. Burnish with an agate tool.

(46) T. B. C. asks: 1. Does sulphuric acid lose its affinity for watery vapor by use? A. It gradually becomes diluted by absorption of the aqueous vapor, and becomes correspondingly less efficient. The rapidity with which this takes place depends altogether upon the apparatus itself and the method of working it, and it can be determined by experiment. 2. Is the acid decomposed or otherwise rendered worthless after using for a certain length of time? A. The acid is not decomposed, but combines with the water to form a hydrate. The acid may be recovered again with all its original strength by evaporating the liquid in large glass or porcelain lined vessels.

(47) F. C. R. asks: What size of engine is best for a boat 25 feet in length and of 7 feet beam? A. One about 4x6 inches would probably answer.

(48) F. H. asks: 1. Do the screw propellers used on ocean steamers have two, three, or four blades? A. They generally have either three or four blades. 2. What is the number of blades on the propeller screws used on the White Star Line? A. We believe that three-bladed Hirsch propellers are used on the steamers of this line.

(49) B. A. J. asks: Why do frozen mercury and red hot iron produce the same sensation? A. They both disorganize the flesh.

(50) T. M. D. asks: What would be a safe pressure to carry in a boiler 12 inches high and 10 inches in diameter, made of $\frac{1}{16}$ inch copper, with a 3 inch flue? A. Safe pressure will be about 15 lbs. per square inch. 2. Would the above boiler do for running a sewing machine with an engine 1½ inches bore and 3 inches stroke? A. Yes, if it be well set.

(51) C. F. and others ask for a recipe for a nickel-plating solution. The following is a good one: Digest the nitrate of nickel in ammonia until it will dissolve no more. Then add a cold, saturated solution of Glauber's salt (sulphate of soda) until a precipitate begins to form. Heat gently for some time, filter, and allow to cool. It is then ready for use.

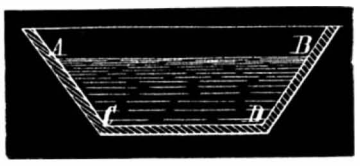
(52) I. F. F. asks: 1. Which is the deepest well in the world? A. The brine well at Kissingen, in Bavaria, is 2,000 feet deep. We believe there is one in Paris nearly 3,000 feet in depth. Perhaps some of our readers can tell us of deeper ones. 2. Can water be taken out of a well 20 yards deep by any other way than by steam, wind, animal, hand, or other power? A. No. Some kind of power be required.

(53) M. H. K. says: We recently melted some silver, using muriate of ammonia and borax as flux. On taking out the ingot it usually shows a granulated surface, similar to that frequently seen on zinc-coated articles. In this case the surface showed (under a glass) fine cracks following the lines of the granulations. Please explain both granulated appearance and cracks. A. The fissures were probably caused either by some impurities in the fluxes employed or contaminations in the metal. When silver is fused, it absorbs oxygen from the air, which is again liberated on cooling.

(54) C. J. A. asks: How much variation would the sixteenth of an inch at the muzzle of a rifle make in the flight of a ball, over 1,000 yards of ground, supposing the gun to shoot correctly, there being no wind to vary the ball in its flight? A. Length of gun from breech to muzzle, in feet :: 3,000 : : 0·0625 : variation at target, in inches.

(55) J. P. B. asks: 1. How can I find the specific gravity of a fluid with a specific gravity bottle containing 100 or 1,000 grains? A. The liquid to be examined is brought to the temperature of 60° Fah., and with it the bottle is filled up to the mark. It is then weighed, the counterpoise being on the opposite scale pan. Divide the weight thus obtained by the weight of an equal volume of pure water at the same temperature. The quotient will be greater or less than unity as the liquid experimented upon is heavier or lighter than water. 2. How much ought a fluid to weigh before dividing it by the contents of the bottle, whose specific gravity is 1·2? A. The specific gravity of the bottle itself is not taken. A counterpoise of the exact weight of the empty bottle is made from a bit of brass, an old weight, or something of the kind, and carefully adjusted by filing.

(56) J. P. M. asks: What is the meaning of "area of way in square feet," and "wet perimeter in feet?" A. If water flows in a trough at



the level, A B, then the area of way is the area of the cross section of the water, A B C D; and the wet perimeter is the length of the line of contact, A C D B, of the cross section of the water with the cross section of the trough.

(57) R. S, M. says: 1. I want to run two 60 saw gin stands at the distance of 300 yards. What size of shaft shall I use? A. Use 2½ inch shafting. 2. What distance should the bearings be apart? A. From 7 to 10 feet. 3. Does the length of the shaft tend to weaken it? A. Yes.

(58) E. D. Z. asks: 1. In building a small sloop, what kind of putty shall I use in the nail holes? A. Mix 10 lbs. whiting with 1 lb. white lead, adding enough linseed oil to give the putty the proper consistence. 2. What size of iron wire rope should I use for the jib stay and for the shrouds, one on each side of the mast, for a main sail of 216 square feet and a jib of 106 square feet? A. Probably the smallest size made for ship's rigging will answer very well.

(59) S. A. C. asks: Would a process, by which the surface of wrought iron while being forged to the desired shape, could be made susceptible to being hardened by plunging red hot in cold water, be of any practical value? A. Yes.

(60) W. F. asks: Why will not smoke ascend through the flues and up the chimney of a boiler which has lain still for four or five days? A. Probably because the draft is imperfect and the connections cold.

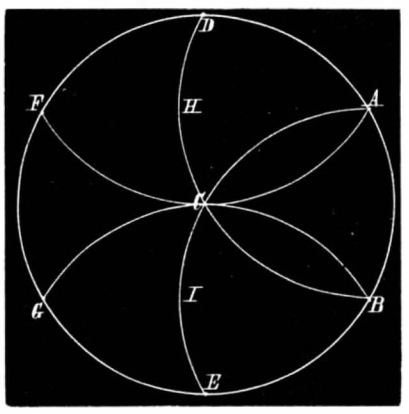
(61) S. D. K. says, in reply to S. H. B., who asked concerning building skiffs: Having decided on the length and width of the boat, take a piece of rough board, as wide as the boat is to be high, and as long as the greatest desired width of the boat. Saw the ends on a bevel of about 4 inches to 1 foot. Then select the boards for the sides, saw the ends to the same bevel as the cross section, and find the center of each. Then nail them by their centers to the beveled ends of the cross section, driving two nails each side half way in so that they can be easily withdrawn. Bring the boards together at both ends, fit stem and stern posts, secure them well, turn the boat bottom up, and true off with drawing knife and plane. Then nail on the bottom, turn over again, true off the top fit knees, knock out the cross section, and the boat is done. This will make a boat as fast as can be made, and of perfect shape. The boat, when finished, should be alike at both ends, and (for speed) about one sixth wide as it is long. The bottom should form a curve of about ¼ of an inch to a foot, both fore and aft and athwartships, as straight lines are not compatible with speed.

(62) J. M. M. says, in answer to J. E. J., who asks if an achromatic spyglass of 50 power would be of any use for astronomical purposes: I have a glass of 35 power, which shows the globular form of the planets, the moons of Jupiter and Saturn, rings of Saturn, sun spots, etc. I have also told the time of day from a clock 10 miles distant. I can discern a man over 20 miles away on a clear day.

(63) C. A. K. says, in answer to R. I. C.'s query as to power for grinding: I have run two pairs of 54 inch burrs with an engine of 25 horse power, grinding 100 bushels per day of 10 hours (60 bushels corn and 40 wheat). The speed of engine was 150 revolutions, that of burrs, 109.

(64) D. J. F. says, in reply to R T. C, who asks how much wheat should a 4 foot stone grind in a day: A 4 foot stone in good order, properly dressed and furrowed, should only grind from 10 to 12 bushels per hour, and do first class work. You can grind from 18 to 24 bushels per hour if you want to, but you cannot do good work at this pace.

(65) R. A. says, in solution of the problem of constructing a perfect square with compasses, without the aid of any other instrument: This is in the rigid sense, impossible, as a square is a figure bounded by right lines. The solution by W. S. D. (who assumes a line, though he omits it in the diagram) only determines the points through which (or to which) the lines should be drawn, but they cannot be drawn with compasses. But the solution is faulty, for he cannot measure half an arc with compasses alone: he only guesses at it. The following solution is subject only to the



objection first stated: From A and B as centers, describe the arcs, B C D, A C E; with C as a center, describe the circle, A B E G F D; with D and E as centers, describe the arcs, A C F, B C G; then will the points, A, B, G, F, form a rectangle, the portion of which between the points, A and B, and the points, H and I, where the right lines from A to F and from B to G would meet the arcs, C D and C F, is a perfect square. My square is not drawn, neither is W. S. D.'s, but the same process which is necessary to complete his will complete mine.

(66) E. R. H. says, in answer to F. A. R., who asks for a rule for measuring ear corn in a crib. Multiply the length, breadth, and hight in inches together, and divide by 3,888. The answer will be the number of bushels of shelled corn.

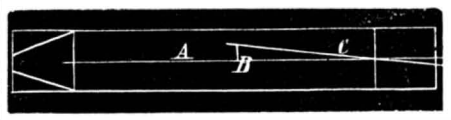
(67) M. R. says, in reply to a correspondent who asks for a remedy for corns: Bind raw cotton on your corn at night before going to bed, and then saturate the cotton with spirits turpentine. It will remove the most obstinate corn, either hard or soft, in four or five applications. The skin will be apt to peel off the toe, but this is rather an advantage, as it helps to remove the corn.

(68) O. P., of Rosloff, Russia, says: In reply to G. W. F., who asks in which position (top or bottom center) of the crank does a locomotive engine exert the most power, you say that there is no difference. I contend that there is a difference; for if the engine is going forwards, and the crank is at the bottom center, it has the full power of the whole area of the piston on it; whereas when the crank is on the top center, the piston rod takes up some of the area of the piston, thus giving less room for steam. When the engine is in back motion, the conditions are reversed. In engines with piston rods running through the whole cylinder, your answer would be correct. Am I right? A. No. When the engine is going forward and the steam is on the rod side of the piston head, the guide bars are relieved of the weight of the connecting rod, guide blocks, cross-head, etc., which quite compensates for the loss of area due to the piston rod.

(69) H. E. W. says, in reply to W. A. S., who asks how he can straighten wire: Put one end, after the wire has been annealed, in the lathe; and fastening the other end so that it cannot turn, start the lathe, and by thus twisting the wire will become perfectly straight and stiff, and not be injured in the least.

(70) C. H. S. says, in reply to M. J. M., who asked for a good rule for setting thimble skeins: The first thing is to lay out your axles correctly. For the gather, measure off on the bottom of the axle half the diameter of the wheel. Then make a point, at ¼ the amount of gather you want, back of the center of your axle at the point measured off. A line from this point, through the center of the axle at the shoulder, will give the gather. For the pitch: Measure as before ⅛ the size of the wheel on the side of the axle. Then measure up, from the bottom of the axle, ⅛ the size of your hind boxing at the shoulder and at the point you have measured off. At this point measure off, above the half diameter of your boxing, one fourth the amount of pitch you want. Thus: If you want your wheels to stand 4 inches wider at top than bottom, measure up 1 inch, etc. A line, from this point through the point at the shoulder will give the pitch. Then measure from this line, each way, half the size of your boxes, and your axle is laid out. To set the skeins, it is only necessary to square down on the end of the axle from the lines you have drawn, each way. Then using their point of intersection as a center, strike a circle the size of your skein inside, at the front end, and taper it to that, uniformly from the shoulder. As a cement to fasten them after they are thus fitted, you will find nothing better than white lead and linseed oil, made as thick as it can be applied nicely.

(71) E. D. P. says, in reply to M. J M.'s question in regard to setting thimble skeins: Draw a line, A, through the center of axle; measure back from shoulder one half the hight of wheel: then mark the dish of wheel, B; about the center line



from this mark, draw line, C, crossing center line at shoulder, and extend to point of skein, which will give you center of skein. Half the diameter of skein below this line will give side of skein at butt and point.

(72) J. E. T. says, in answer to the query as to the side of the largest cube that can be cut from a ball 12 inches in diameter: It is evident that the longest possible diagonal of the cube is 12 inches. Now the square of the longest diagonal of a cube is equal to three times the square of either side; therefore the square of diagonal=144, which divided by 3 gives 48. The square root of 48= 6·9282+ =side of square. [This answer is correct. A. I. F. and J. D. E. have sent similar replies. L. S. W.'s reply, on p. 267, vol. 34, is erroneous.—EDS.]

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. W. F.—It consists principally of salt, with some blue dye.—T. I. H.—They are rolled fragments of quartz.—I. R.—The principal constituents are silica, silicate of alumina, and oxide of iron. A complete analysis would show the presence of 5 or 6 other constituents. The cost of the analysis would depend upon its completeness. If you desire a qualitative analysis, with the total amounts of solid mineral and organic constituents, the cost would be $12, and the amount of water required will be ⅛ gallon; if a complete quantitative analysis, as well, the cost would be $35, and the amount of water required 2 gallons.—L. M. N.—It appears to be resin, containing tarry matters, borax, and paraffin.—W. M. S.—Your boiler scale is not dangerous. It is clay, oxide of iron, and carbonate of lime.—N. D. S.—It is decomposed granite. The shining scales are muscovite.—J. F. W.—It is aventurine, and a specimen of it is in every mineral cabinet.—G. B. L.—No. 1 is sulphide of zinc. No. 2 is oxide of iron and clay.—A. W. D.—No. 1 is sand, clay, and quartz, of no value. No. 2 is sulphide of zinc.—J. T.—We find only iron pyrites.—J. S. W.—It is celluloid.—S. L. S.—It is trap rock, containing a small percentage of iron. It is not an iron ore.—R. G. S.—It is sulphuret of iron and copper.—C. A. B.—From its appearance, it would be well to give it a practical trial as fire clay. It should be profitable.—L. W. S.—They are beautiful crystals of selenite, commonly called gypsum or sulphate of lime.—C. W.—It is principally nitrate of soda, with a small percentage of chloride of lime and magnesia.—H. E. B., of Wilson, N. C.—It is hydrated sesquioxide of iron or brown hematite. It is probably worth mining.—A. B. R., of West Burke, Vt. They are sulphides of iron and copper.—We have several letters from which the specimens have escaped in course of transit; and we recommend our correspondents to put each specimen securely in a box and mark it with the name and address of the applicant.

J. L. asks: What is the process employed in making photographic tin types?—A. P. B. asks: How is mica split?—C. A. K. asks: How can I find the area enclosed between the arc and the radius vectors of an ellipse (said radii being drawn from one of the foci), if the semi-axis major, the angle subtended by the radii, and the eccentricity of the ellipse are given?—J. T. asks: Can any one oblige me by describing the photo-engraving process and the photo-lithographic process?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a New Hydrometer. By H. W.
On a Pendulum in a Mine. By J. M. H.
On the Glacial Epochs. By J. H.

Also inquiries and answers from the following:

C. J. R.—G. A. P.—J. T. H.—N. R.—E. A. D. P.—J. D. E.—N. M. W.—J. W. S.—C. C. L.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes lamp chimneys of tempered glass? Who sells drawing instruments? Who sells an engine worked by ignited petroleum? Who makes the best lenses for photographic portraiture? Why do not dealers in photographic chemicals advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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INDEX OF INVENTIONS

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[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specification and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city.

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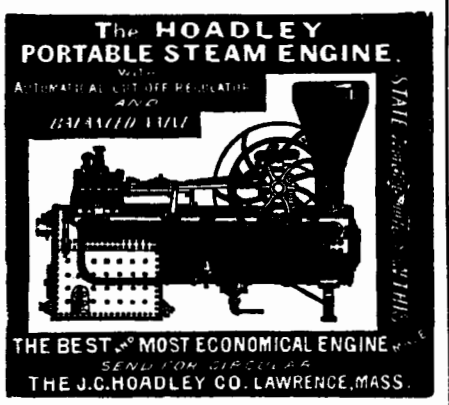

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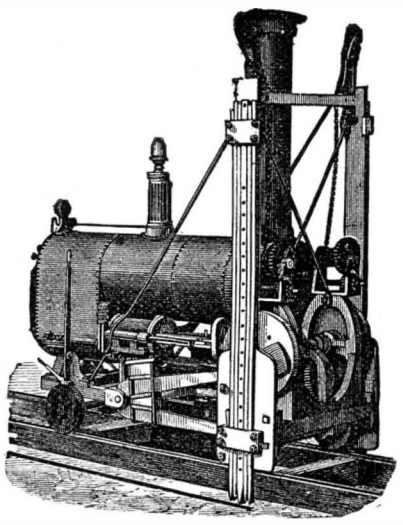

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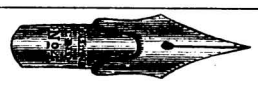
THE  BEST GOLD PENS

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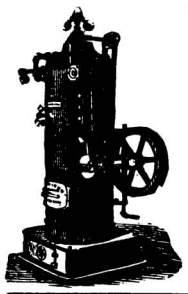

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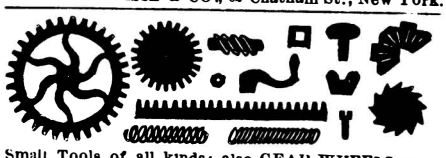

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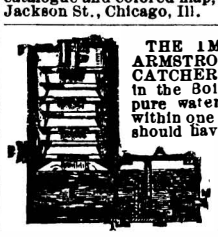

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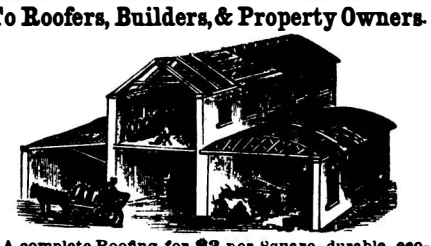

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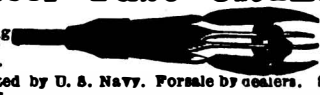

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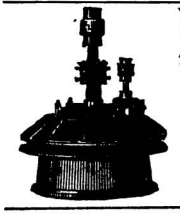

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